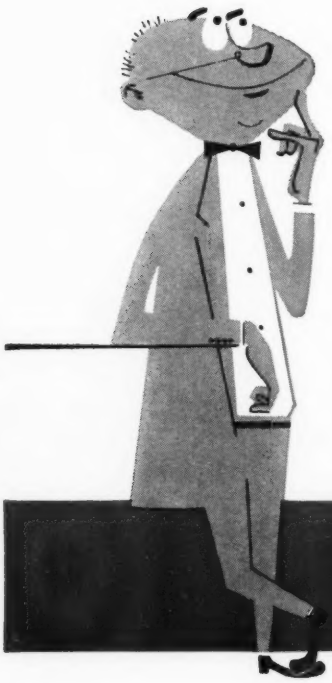
Mining CONGRESS JOURNAL

SEPTEMBER
1955

Featuring **Metal and Nonmetallic Mining Convention**

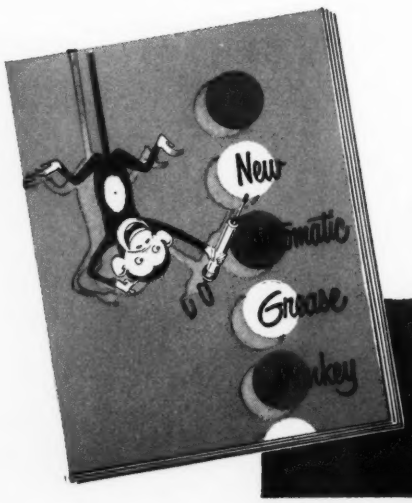
BEARING TROUBLES?

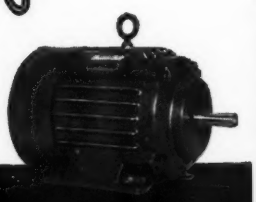


NO SIR! Not with new Reliance Motors and METERMATIC .... the

Automatic Grease Monkey

I found out how to put an end to burned out bearings from the Reliance Metermatic Bulletin, A-2406. Why don't you write for one? A-1409





RELIANCE ELECTRIC AND ENGINEERING CO.

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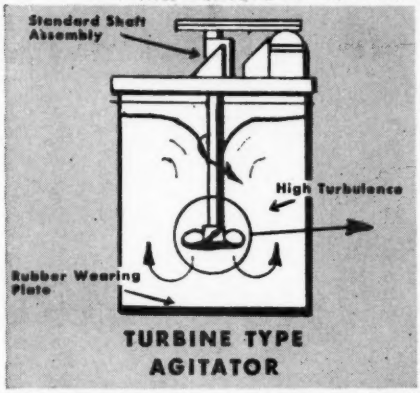
Here are the tools to help you solve your Agitation problems and *Increase Profits!*

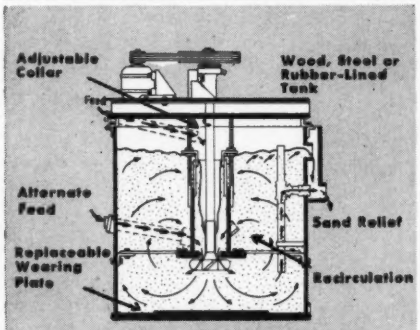


TURBINE TYPE AGITATOR

DENVER Agitators for mixing and leaching

(Copper, uranium, vanadium, lithium, cobalt, zinc)

Denver Agitators and Conditioners are the only machines that are flexible enough to be adapted to meet changing ore conditions. Heavy duty construction gives you dependable service 24 hours a day!

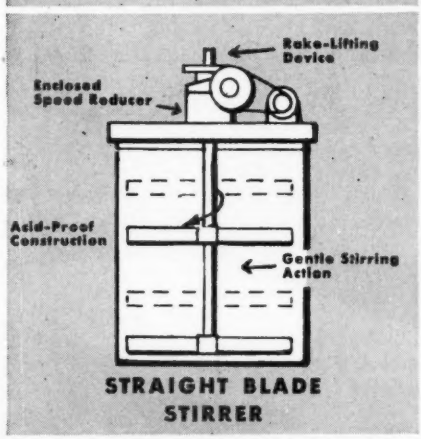


SUPER AGITATOR AND CONDITIONER

DENVER Agitators for flotation

(Barite, phosphate, fluorspar, iron, lead, zinc, copper feldspar)

The patented Denver standpipe gives you a flexible tool to change agitation and aeration to meet your exact requirements. These fool-proof machines will mechanically do your job—low maintenance.



STRAIGHT BLADE STIRRER

DENVER Agitators for precipitation

(Vanadium, lithium, uranium, copper)

This new machine was designed by DECO engineers especially to meet the needs for leaching operations in the Uranium industry—complete suspension of solids without excessive agitation. It is another example of how DECO engineers help their customers solve special jobs!

Our Bulletin A2-B4 describes these Denver Agitators in detail.

WHAT DELIVERY DO YOU NEED? INVESTIGATE NEW LOW PRICES!

"The firm that make its friends happier, healthier and wealthier"

DECO FLOTATION ENGINEERS — DENVER EQUIPMENT COMPANY 24 HOUR SERVICE

DENVER EQUIPMENT COMPANY

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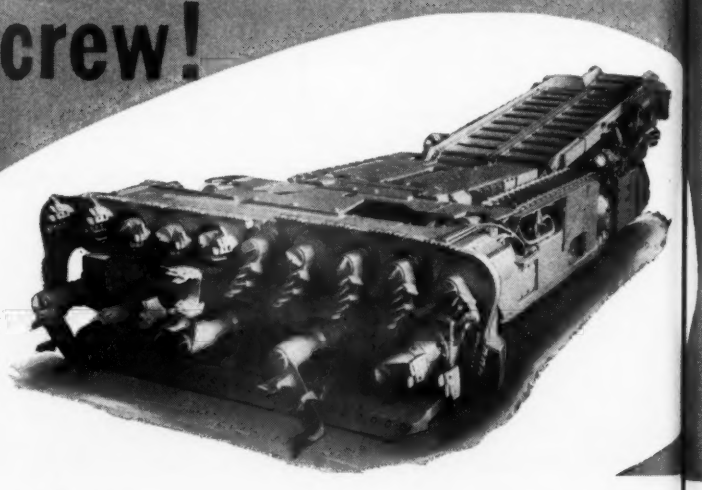
Denver • New York • Chicago • Salt Lake City • Toronto • Vancouver • Mexico D.F. • London • Johannesburg

in its first 38 days, a new JEFFREY 76-AM COLMOL PATENTED mined 25,585 tons* in 76 shifts...in low coal 38" to 44" high...with a crew of only 7 men... an average of 336.7 tons per shift or 48.1 tons for every man charged to the COLMOL crew!

*All tonnages cited are for clean coal. Raw coal mined ran 5% more.



On March 21, a new Jeffrey 76-AM COLMOL began production at a progressive mine working a coal seam 38″ to 44″ high. Even though crews were trained right on the job, this low-vein continuous mining machine achieved the outstanding tonnages shown.

Remember, these were the *first* 38 production days, with records kept from the minute the new COLMOL made its first lift. Even better averages are now being set as crews become skilled teams and the COLMOL hits the high-stepping stride for which it was designed.

During the first 38-day period, shift peaks were hit of 470, 480, 490, 500 and 520 tons. Just 7 men were charged to each COLMOL crew. Note in column at right how tonnage totals began to climb as crews gained experience. On May 12 (the 39th day) one crew mined 625 tons!

The 76-AM was the second COLMOL installed at this mine. The first COLMOL, with experienced crews, mined 31,195 tons in 76 shifts during the same 38-day period. Average for the older COLMOL was 410.5 tons per shift or 58.6 tons for every man charged to the 7-man crews.

Such production proves this fact: the COLMOL produces high tonnage per man-shift from the very first day of operation. With tons-per-man-shift averages like 48.1 for new crews . . . and 58.6 for veteran crews . . . the COLMOL is your very best bet for low vein continuous mining.

DESCRIPTION OF MINE: Seam varies from 38 to 44 inches. Seam is relatively flat with firm top. At times a weak drawslate and bone up to 6 inches thick come with the coal. Above this the main top is firm.

MINING METHOD: Series of 9 headings is advanced. Headings are driven about 26 feet wide on three lifts. COLMOL advances in single pass to depth of 42 feet, backs up and makes second and third passes to same depth. Cycle is repeated after 42 feet of conveyor line is added. Breakthroughs are driven in two lifts, 18 feet wide every 75 feet. After air is established by alternating in driving up #1 and #2 headings for 300 feet, the COLMOL moves to #3 and advances it 300 feet. The remaining headings are driven similarly to #3. Headings are spaced on 60-foot centers.

COLMOL is supported by a loader to which a bridge conveyor is attached. Bridge conveyor discharges on to chain conveyor. Chain is advanced in 7-pan or 42-foot increments. Coal then dumps on cross chain conveyor which feeds mother belt line.

COLMOL CREW: 1 COLMOL Operator, 1 Loader Operator, 1 Helper, 1 Timberman, 1 Supplyman, 1 Mechanic, 1 Foreman. TOTAL: 7 Men.

Write Mining Sales Division, The Jeffrey Manufacturing Co., Columbus 16, Ohio, for COLMOL Bulletin 877.

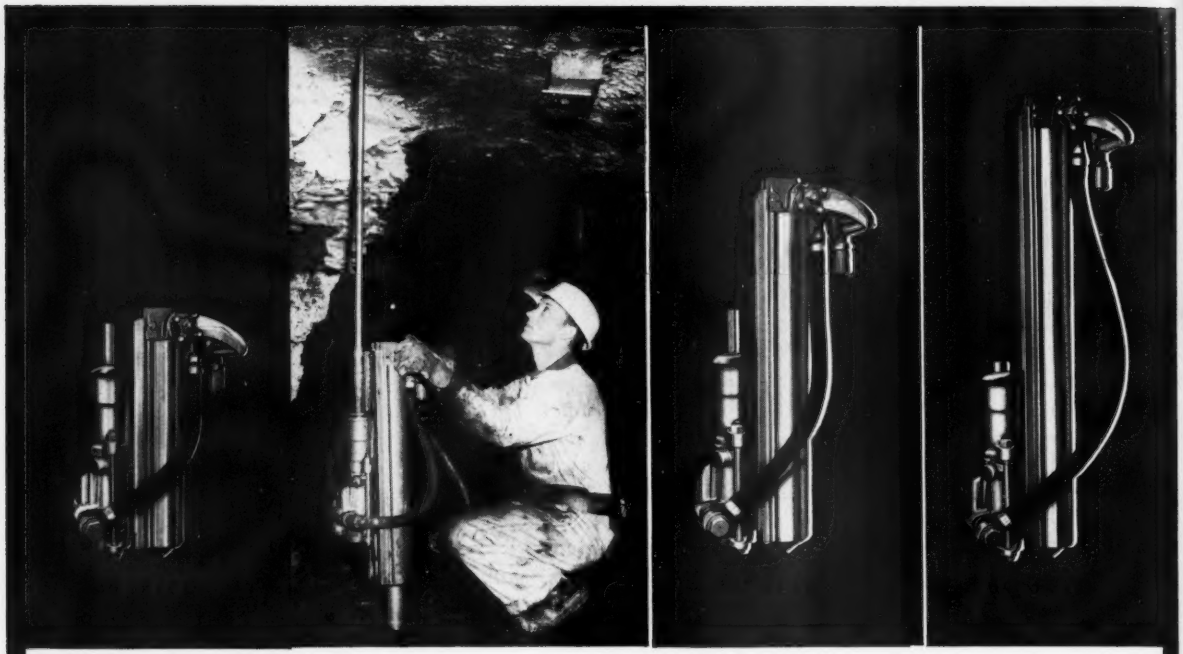
TWO-SHIFT TOTALS

TONNAGES RECORDED AS CLEAN COAL—RAW COAL MINED WAS 5% MORE

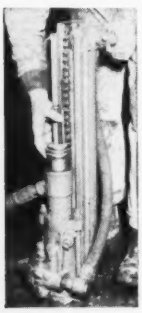
Dates	New COLMOL (inexperienced crews)	Older COLMOL (experienced crews)
March		
21	160	855
22	460	700
23	705	940
24	540	780
25	610	790
28	520	750
29	880	890
30	630	875
31	790	860
April		
4	570	960
5	620	540
6	815	795
7	760	780
8	570	700
11	770	890
12	715	1000
13	800	950
14	690	820
15	650	615
16	620	615
18	755	940
19	775	850
20	700	865
21	590	750
22	685	710
25	540	740
26	690	940
27	320	775
28	890	795
29	670	910
May		
2	780	945
3	720	850
4	690	910
5	800	890
6	430	680
9	865	800
10	860	820
11	950	920
TOTALS	25,585 Tons	31,195 Tons

JEFFREY

MINING • CONVEYING • PROCESSING EQUIPMENT
TRANSMISSION MACHINERY • CONTRACT MANUFACTURING



Remove Snap Ring



Remove Chuck

THE CLEVELAND S20 VAC-NU-MATIC STOPER

All models available in either SAV-A-CHANGE or Socket Type Chuck

● The new CLEVELAND S20 VAC-NU-MATIC dust collecting stoper is available in 3 feed lengths to suit any working height down to a 26" seam. *It will produce a 30" hole in a 26" seam without using coupled steel.* The 28" feed weighs 69 lbs. complete. Any model may be used either hand held or jumbo mounted. VAC-NU-MATIC bits are fast and free cutting and eliminate all stuck steels. Dust collection is positive even in wet top. Chucks may be replaced without dismantling the machine, using only a pair of snap-ring pliers. Cuttings are removed at the chuck housing and do not pass through the machine. Write for bulletin RD32 or let us demonstrate in your own mine.

For sales, service, information or demonstration in Pennsylvania and West Virginia contact: Schroeder Brothers — 3116 Penn Ave., Pittsburgh, Pa. or Acme Machinery Co. — Williamson, W. Va. In the Birmingham district contact Equipment Service Co., 617 North 9th St., Birmingham, Ala., or contact us direct from anywhere.

CLEVELAND ROCK DRILL DIVISION
Westinghouse Air Brake Company
12500 BEREA ROAD • CLEVELAND 11, OHIO

RD-74

SEPTEMBER, 1955

VOLUME 41 ● NUMBER 9

Mining

CONGRESS JOURNAL

CONTENTS

FRONT COVER: Hoover Dam and Lake Mead—Lake Mead recreation area has recently been opened to uranium prospecting

EDITORIALS 41

MINE HOISTS WITH DUAL AC-MOTORS OPERATED SUCCESSFULLY 42
By W. Trent Newland and A. H. Myles

COST REDUCTION THROUGH INDUSTRIAL ENGINEERING..... 46
By Victor L. Hurley

MINING GOES TO LAS VEGAS..... 50
Official Program 54

POWER REACTOR DEVELOPMENT IN THE UNITED STATES..... 64
By W. Kenneth Davis

CONSIDERATIONS IN DESIGNING A MINE HAULAGE SYSTEM—Part II 68
By Stephen Krickovic

OPERATIONS RESEARCH APPLIED TO ORE RESERVES AT RIDDLE 71
By W. R. Van Voorhis, L. E. Andrews, Jr. and G. D. Creelman

FOUR YEARS OF ROOF FALL ACCIDENTS..... 78
By George W. Sall

THE ESTIMATION OF URANIUM-VANADIUM RESERVES ON THE COLORADO PLATEAU 80
By A. L. Bush and H. K. Stager

OPERATORS CORNER 83
Wet Down Limestone Automatically
V-Belt Storage

WHEELS OF GOVERNMENT..... 84

PERSONALS 86

NEWS AND VIEWS..... 89

MANUFACTURERS FORUM 109

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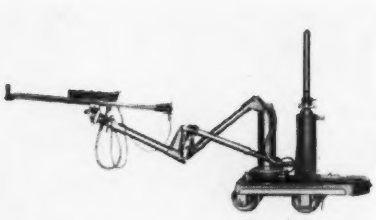
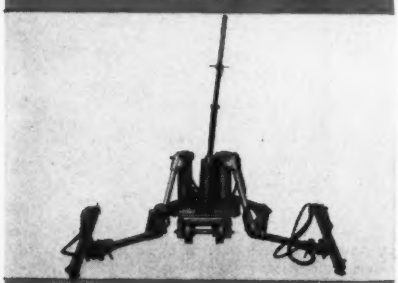
NEW Thor MINING

FOR FAST LOW-COST DRILLING IN YOUR MINE...SPECIFY THOR

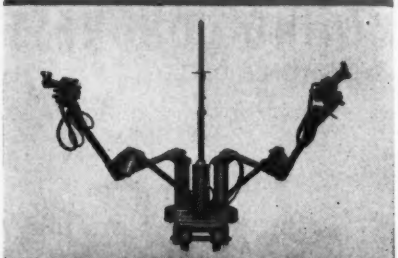


THOR SINGLE BOOM JUMBO

THOR DOUBLE BOOM JUMBO



FASTER GROUND LEVEL DRILLING



EASIER OVERHEAD DRILLING

- ✓ **COMPLETELY OPERATED BY AIR**—No hydraulics.
- ✓ **EASIEST TO SET UP**—Elimination of many time-consuming operations such as blocking, use of extension rods and constant adjustment of the jack provides faster, easier set-ups.
- ✓ **EASIEST TO OPERATE**—Horizontal swing of the boom is automatically locked by air pressure . . . and may be controlled by the operator without leaving his drilling position.
- ✓ **DRILLS ROUNDS FASTER**—When air pressure is released from the boom column . . . very little effort is required to swing the boom to a new position. Apply the air pressure and drill a new hole.
- ✓ **QUICK STEEL CHANGES**—New Thor Power Feed Drifter Mountings, with rapid advance, rapid return and full power feeding at all speeds assure fast efficient drilling, faster steel changes, fewer stuck steels, and reduces total man-hours of labor per hole drilled.
- ✓ **LOW MAINTENANCE COSTS**—Hollow boom carries all supply and control pipes, protecting them from injury. Air motor may be removed without disturbing the boom. Boom actuating screw is hermetically sealed to prevent the loss of lubricant and avoid abrasive damage by foreign matter.

New Thor Jumbo easily disassembles to 3 parts facilitating handling in mine cages.

Illustrated is Two-Boom style . . . One-Boom and Special Models available, details on request.

SPECIFICATIONS

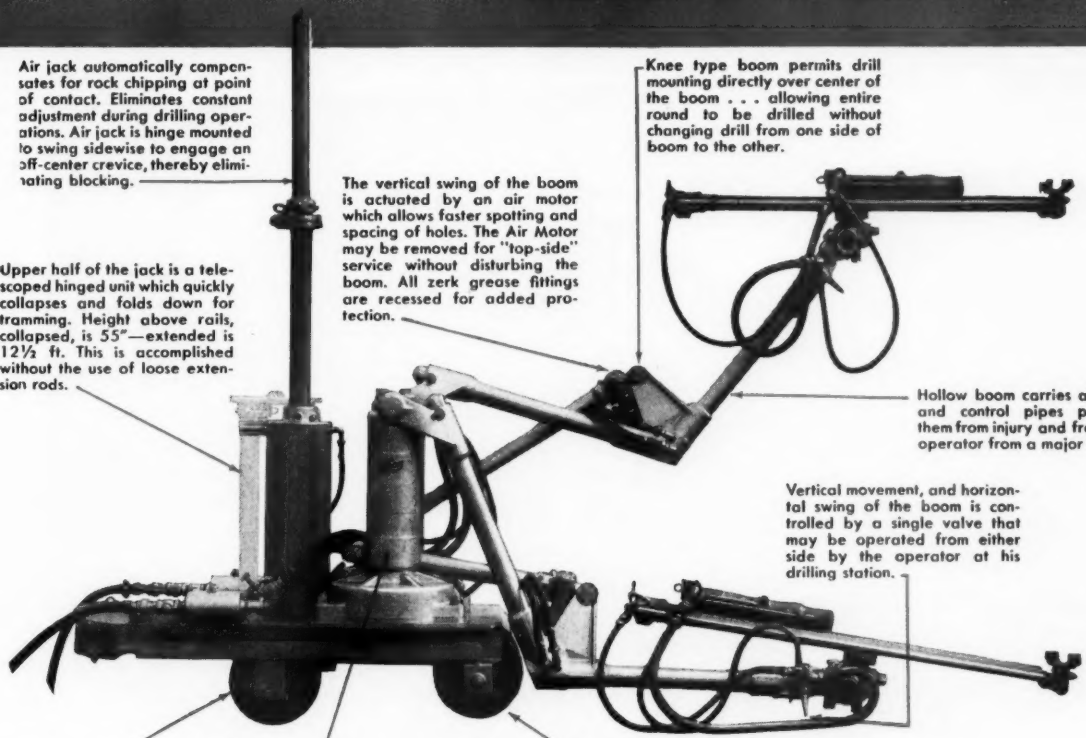
	1 Boom DB-100	2 Boom DB-200
Size of Chassis	18" x 35" x 80"	18" x 35" x 80"
Wheel Base	36"	36"
Track Gauges	18"	18"
Size Heading Recommended	8' Wide x 10' High	12' Wide x 10' High
Weight Bare	3600 lbs.	6000 lbs.
Crated For Domestic	3700 lbs.	6100 lbs.
Boxed For Export	4000 lbs.	6400 lbs.
Air Lines	1" Hose	1" Hose (Double)
Water Line	½" Hose	½" Hose (Double)

Boom Column Complete: Bare.....1530 lbs.
Crated For Domestic.....1650 lbs.
Boxed For Export.....1750 lbs.

THOR Mining Congress Headquarters
October 10-13, 1955
Hotel SAHARA, Las Vegas, Nevada

JUMBO

DESIGNED BY THOR ENGINEERS IN CLOSE COLLABORATION WITH ENGINEERS OF THE MINING INDUSTRY



Air jack automatically compensates for rock chipping at point of contact. Eliminates constant adjustment during drilling operations. Air jack is hinge mounted to swing sidewise to engage an off-center crevice, thereby eliminating blocking.

Knee type boom permits drill mounting directly over center of the boom . . . allowing entire round to be drilled without changing drill from one side of boom to the other.

The vertical swing of the boom is actuated by an air motor which allows faster spotting and spacing of holes. The Air Motor may be removed for "top-side" service without disturbing the boom. All zerk grease fittings are recessed for added protection.

Upper half of the jack is a telescoped hinged unit which quickly collapses and folds down for tramming. Height above rails, collapsed, is 55"—extended is 12½ ft. This is accomplished without the use of loose extension rods.

Hollow boom carries all supply and control pipes protecting them from injury and freeing the operator from a major nuisance.

Vertical movement, and horizontal swing of the boom is controlled by a single valve that may be operated from either side by the operator at his drilling station.

Rear wheels are spring mounted allowing car body to set on the track when the air jack exerts pressure on the ceiling or back . . . This feature makes the car a rigid platform for the operation of the drill—eliminates time consuming clamping and blocking operations.

Boom column air piston under pressure automatically locks the horizontal swing of the boom preventing boom drift and binding during drilling operations. When air pressure is exhausted boom will swing with very little effort.

Large 14" wheels mounted on Timken Bearings for easy rolling. Wheel treads are 3½" wide to compensate for variable gauge track. Practically eliminates de-railing difficulties.

FIELD-TESTED FOR 3 YEARS

THIS new Thor engineered Jumbo with simplified operating controls, is packed full of new design features . . . features that will speed your drilling operations. You can set up . . . drill a round . . . and remove this Thor Jumbo from the face in less time and with less effort than any other similar machine on the market today. Write for additional information on how this new Thor Jumbo will speed your mining operations . . . or, if you request we will send a Thor Mining Engineer to give you personal on-the-job assistance. Write Thor Power Tool Company, Aurora, Illinois.

Thor

THOR POWER TOOL COMPANY

AURORA, ILLINOIS

EXPORT DIVISION: 250 West 57th Street, New York 19, N. Y.

In this kit is the answer to all your conveyor belt needs!

THE LID'S OFF!
Now, for the first time, you can see in miniature a conveyor belt designed to your exact specifications... built right before your eyes... in only a few minutes of your time, on just a few inches of desk space. And this "U. S." Conveyor Belt Construction Kit can save your company countless hours, thousands of dollars of expense.

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Whether or not your present system has been giving you good service, you owe it to yourself to look into this unique and comprehensive analysis of your conveyor belt needs.

Absolutely free—no obligation whatsoever. It is strictly a service of United States Rubber Company. A "U. S." Sales Engineer will contact you in the near future. Or better still, why don't you call any one of the 27 "U. S." District Sales Offices and set up an appointment to see this remarkable new method of analyzing your conveyor belt requirements?

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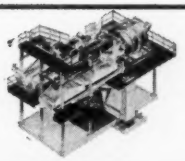
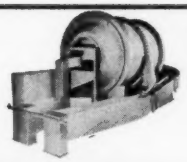
Wemco answers your coal cleaning problems



WEMCO HMS MOBIL-MILLS

World's most widely used heavy media separation plants; available with a choice of separatory vessels; capacities 25 to 500 TPH; will handle feed range from 8" to 3/32".

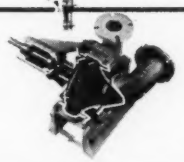


TWO-COMPARTMENT DRUM SEPARATORS

Two-gravity, three-product heavy media separation in one vessel. Less than 1% misplaced material on a feed of 114 TPH of 2½" x ¼" coal indicated in typical operating report.

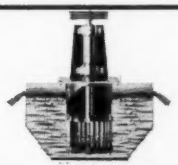
WEMCO HMS EQUIPMENT FOR CUSTOM PLANTS

Separatory drums and cones, densifiers, medium pumps and media reclamation circuits of the superior designs so thoroughly proven in the Wemco Mobil-Mills.



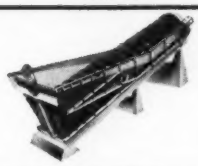
WEMCO TORQUE-FLOW SOLIDS PUMP

A remarkable new pump that can handle chunks up to several inches in diameter; available in capacities 100 to 3,000 GPM; handles heads up to 120 feet.



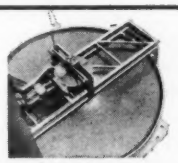
FAGERGREN FLOTATION MACHINES

Most efficient per cubic foot of all modern flotation machines. Extract saleable coal in the range from 14 to 325 mesh plus solving disposal problem.



WEMCO COAL SPIRALS

Efficient, low cost dewatering and/or sizing device that achieves more complete moisture removal than the drag tank; also fewer working parts and no stalling problems.



WEMCO HYDROSEPARATORS

High capacity means for making an efficient separation in the 200 mesh range; used to deslime coal ahead of tabling or flotation; diameters to 150 feet.

WEMCO LABORATORY SERVICES

All necessary tests are available to determine practicability of various coal cleaning methods for treating your run-of-mine coal.

WEMCO THICKENERS

The perfect compromise between acreage and horsepower in clarifying water for closed circuits, or for pollution-free stream disposal; diameters to 400 feet.

The full available information on any of the above equipment items will gladly be mailed in answer to your inquiry. More detailed recommendations for your specific coal cleaning problem will also be furnished, if desired. Write Dept. I-2212

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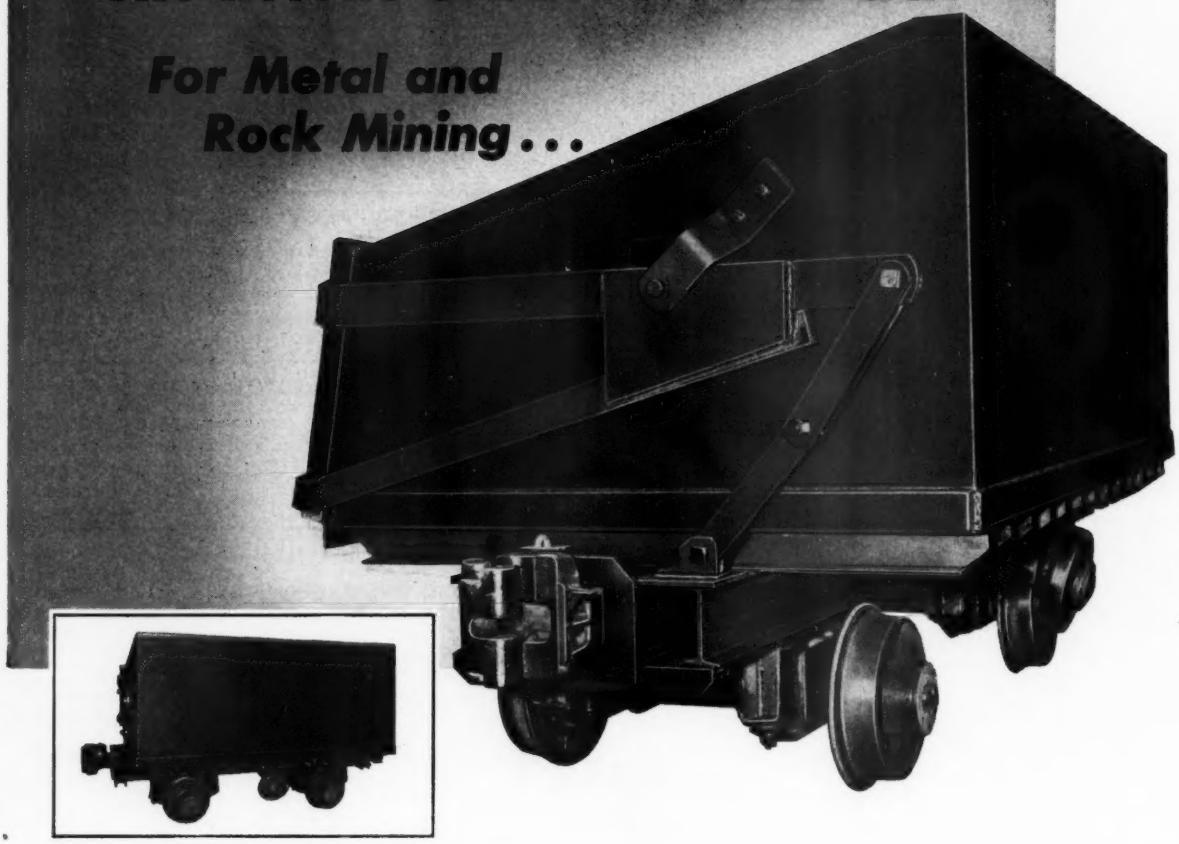
Representatives in principal cities of the United States and Canada and in major countries throughout the world.

Rough-tough-rugged

The IRWIN GRANBY TYPE CAR

For Metal and Rock Mining...



Now from the makers of the famous, time-proven Irwin Mine Cars comes this heavy duty Granby type car. Designed and built especially to successfully withstand the shocks and rough treatment of high-production metal and rock mining.

Weighing 8000 pounds with a capacity of 133 cubic feet, this third rail dumper is strongly reinforced throughout by rugged I beams. Furnished in any capacity for any track gauge.

Cut your haulage costs and reduce maintenance the Irwin way. For further data write Dept. 513, Irwin Foundry and Mine Car Co., Irwin, Pennsylvania.

IRWIN

IRWIN FOUNDRY & MINE CAR COMPANY

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MANUFACTURERS of MINE and INDUSTRIAL CARS Since 1903

GM DIESEL
CASE HISTORY No. IA3-15

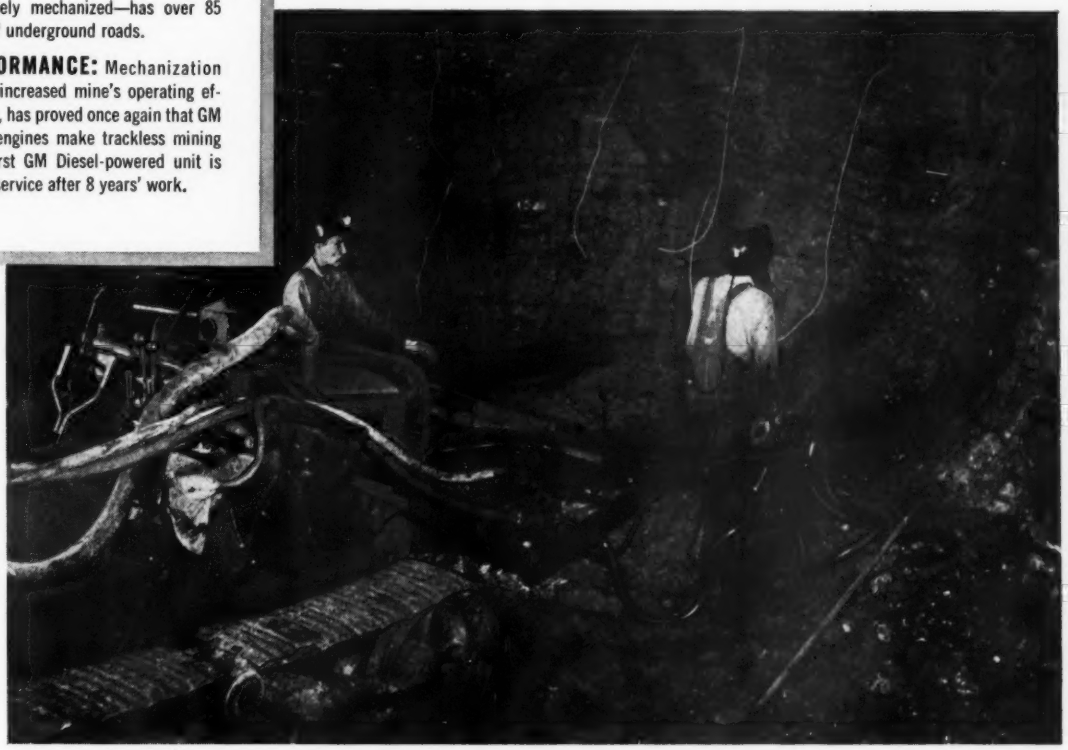
OWNER: Eagle-Picher Company, Miami, Oklahoma.

INSTALLATION: 50 GM Diesel-powered ore haulers, shovels, drills and personnel cars in zinc mine. Mine is completely mechanized—has over 85 miles of underground roads.

PERFORMANCE: Mechanization greatly increased mine's operating efficiency, has proved once again that GM Diesel engines make trackless mining pay. First GM Diesel-powered unit is still in service after 8 years' work.

8 years underground

and still going strong



TO A General Motors 2-cycle Diesel engine "home" is where the job is. That's why you'll find both underground and surface (strip) miners specifying GM Diesel power for their mines.

In the Eagle-Picher underground mine, GM Diesel engines equipped with exhaust scrubbers keep production on the move.

And in both deep mines and strip mines GM Diesels help move more tons at less cost. Their 2-cycle operation with power at every piston downstroke means faster acceleration, less time spent per haul trip or bucket swing. What's more, you can run a GM Diesel for a lifetime because all parts and components are easily replaced.

Eagle-Picher executives say the local GM Diesel distributor was "invaluable" in working out some of their power problems. Back of the low-cost performance of GM Diesels *everywhere* stands a network of distributors ready to give you service and fast delivery of low-cost parts. These GM Diesel distributors are power experts. Call the one nearest you today for details on GM Diesel power for your mine.

DETROIT DIESEL ENGINE DIVISION
GENERAL MOTORS • DETROIT 28, MICHIGAN
Single Engines . . . 30 to 300 H. P. Multiple Units . . . Up to 893 H. P.

VISIT GENERAL MOTORS POWERAMA Gala Celebration of 100 Million GM Diesel Horsepower—Lake Shore South, Chicago—Aug. 31st through Sept. 25th

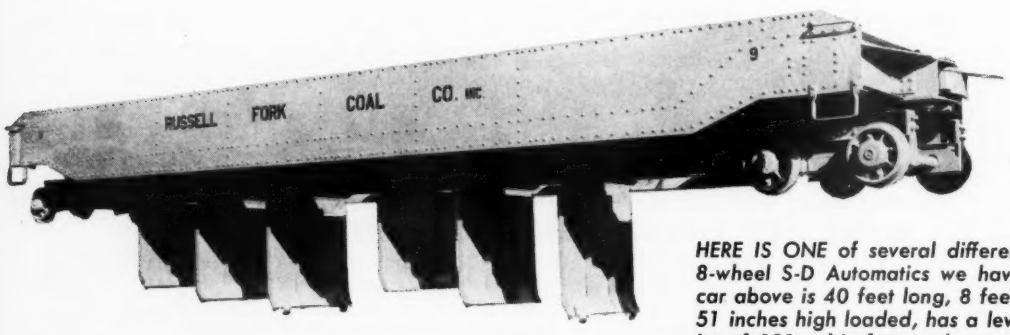
ONLY S-D AUTOMATIC bottom dumping cars give you these advantages: (1) "Twin Safety Latches" for safe and sure latching . . . (2) Safety Sealed against dust leakage and (3) ¼ to ½ ton more capacity per car for the same overall dimensions.

Sanford-Day ... coal Super

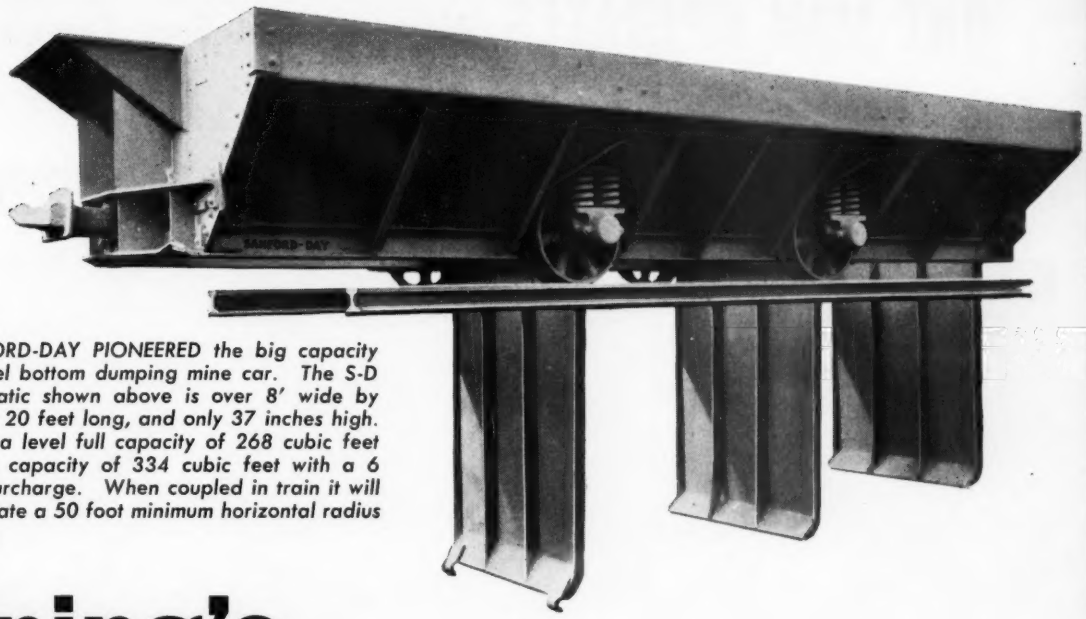
Is there something special you need in mine cars . . . a feature to meet your particular requirements? You probably will find the answer in our plant. Down through 50 years of car building experience we have solved the major problems of mine haulage.

Regardless of the type car you need, we build it . . . cars so constructed to give you the more years of service with the least maintenance. Shown here are just a few of many different types and all built to give you superior service for the lowest dollar.

Regardless whether you need one car or 101, don't hesitate to get one of our engineers into your mine with your officials — face to face with your problem. With this type of cooperation, plus our facilities and capacity to build any type mine car of any size, any haulage problem in your mine can be solved.



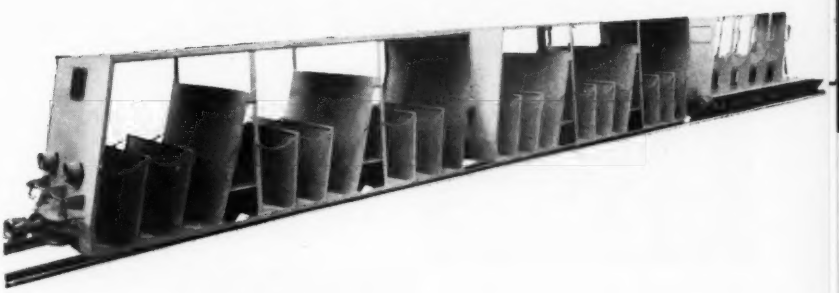
HERE IS ONE of several different designs of 8-wheel S-D Automatics we have built. This car above is 40 feet long, 8 feet wide inside, 51 inches high loaded, has a level full capacity of 831 cubic feet and a capacity of 996 cubic feet with 8" surcharge. This car was equipped with 18" ball bearing cast iron wheels on trucks and may be supplied with or without automatic couplers.



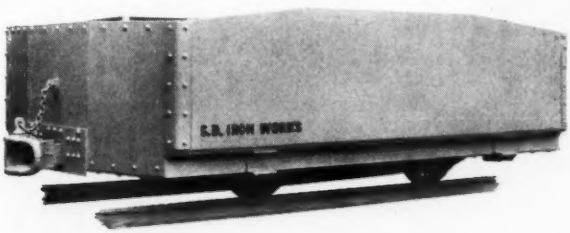
SANFORD-DAY PIONEERED the big capacity 4-wheel bottom dumping mine car. The S-D Automatic shown above is over 8' wide by almost 20 feet long, and only 37 inches high. It has a level full capacity of 268 cubic feet and a capacity of 334 cubic feet with a 6 inch surcharge. When coupled in train it will negotiate a 50 foot minimum horizontal radius curve.

mining's Market for mine cars!

FROM THE WHEELS UP, S-D Man Cars are built into one compact, all-steel unit for safety, comfort and low cost. The S-D Man Cars pictured were developed to operate on a slope with an S-D Safety Control Car. A similar car, the S-D Brakeman Car, also incorporating electrically operated magnetic shoe brakes, eliminates skids and additional locomotives for braking trips down grades.



S-D ROTARY DUMP CAR: We developed the "low-floor" types of large capacity cars and S-D "Whopper" cars to give you more capacity for any given overall dimensions. Car pictured at left is equipped with stub axle spring mounted trucks.



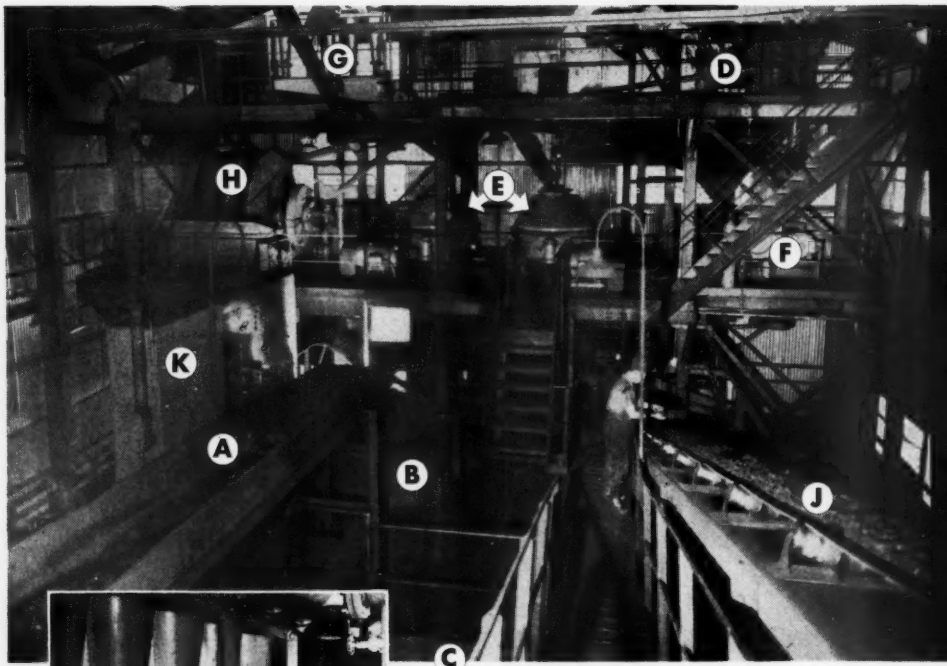
Sanford-Day IRON WORKS

KNOXVILLE • TENNESSEE

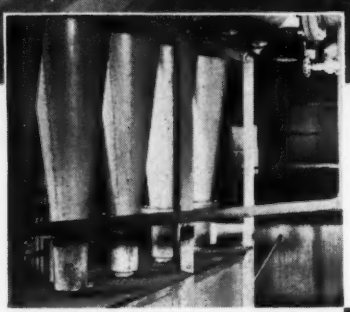
AND **BROWN-FAYRO** DIVISION

MINE CARS, All Types - PRECISION WHEELS - "Brownie" HOISTS CAR RETARDERS - SPOTTERS PUMPS - OIL SPRAY SYSTEMS

ONE MAN OPERATES Westmoreland Coal Company's New Fine-Coal Washing Plant . . . Designed and Built by Heyl & Patterson



A. Raw Coal Feed Sluice
B. H & P 8 way Impulse Distributor
C. 8 Deister Tables (located on ground Floor)
D. Clean Coal Preliminary Dewatering Screen
E. 2 Reineveld 36" Fine-Coal Dryers
F. Cyclone Feed Pump
G. Five 14" H & P Cyclones
H. Vacuum Filter
J. Clean Coal Belt Conveyor
K. Control Panel for all Equipment

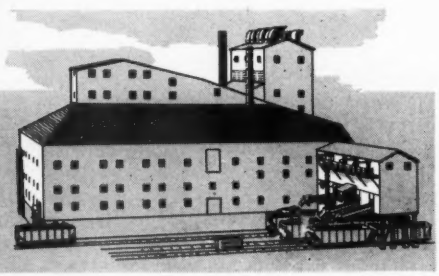


H & P Cyclones produce a slurry having 40%—50% concentration and containing—28 mesh solids (an ideal filter feed) at the rate of 15 TPH.

One man operation is possible because all operating units are visible from the operator's station. This modern plant processes 100 tons per hour of 3/8" x 0" raw coal feed. It recovers 100% of the clean coal from the tables because the coal circuit is completely closed. It produces a product containing 7½% surface moisture in the 3/8" x 0" size.

The raw coal feed is from the Irwin Basin of the Pittsburgh Seam. This Criterion Coal is sold by the General Coal Co., sales agents. Specifications called for clean coal of not more than 5½% ash and .9% sulphur. This H&P designed washing plant is consistently meeting these requirements.

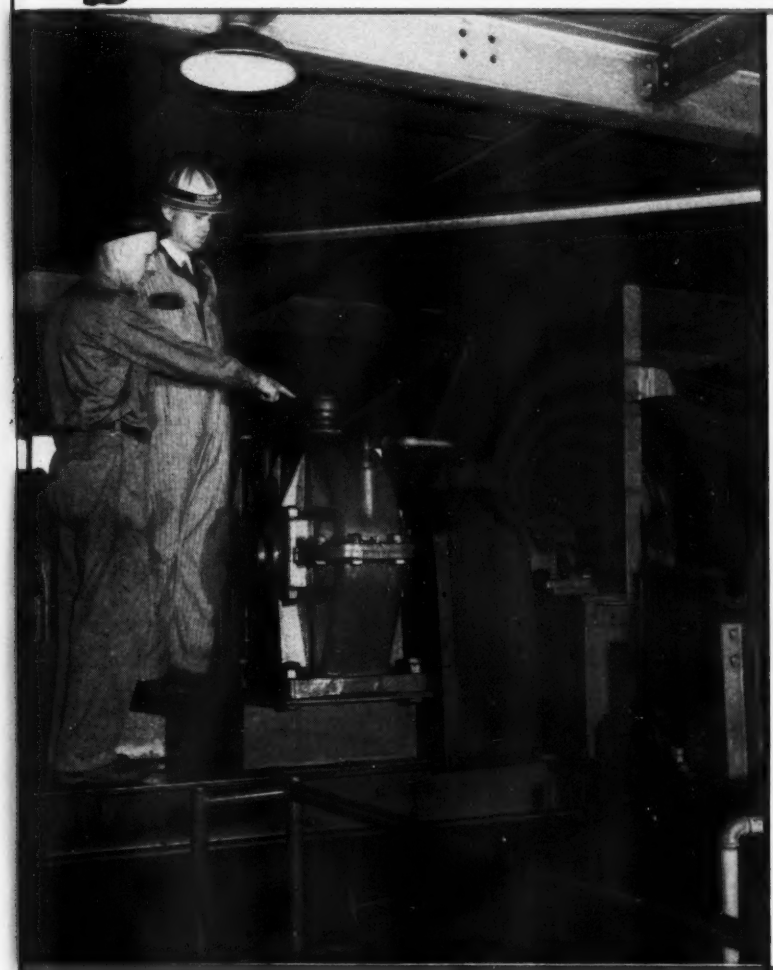
Two 36" Reineveld Fine-Coal Dryers produce 70 TPH of fine coal with a surface moisture of 4.5%—5.5%.



Heyl & Patterson INC.

55 FORT PITT BLVD. PITTSBURGH 22, PA. PHONE COurt 1-0750

Speed reducer at Fairview Collieries Corp. uses STANOIL *Industrial Oil— operates 5 years with no mechanical maintenance*



Management of Fairview Collieries Corp., Danville, Illinois, had had experience with STANOIL Industrial Oil. So when it came to selecting an oil for a speed reducer in the preparation plant, the choice was easy—STANOIL.

The speed reducer is connected to a belt conveyor that moves nearly 10 tons of coal per minute. A shut down of the speed reducer means the conveyor belt stops and the whole plant shuts down. Obviously this is no place for oil failure. Obviously, too, it *is* the place for STANOIL Industrial Oil.

STANOIL in the speed reducer is changed approximately every twelve months. After five years' continuous operation, the speed reducer is in excellent condition. Herringbone gears and other parts show no evidence of wear. No maintenance work has been necessary. No shutdown has occurred due to lubrication failure.

Ask your Standard Oil lubrication specialist about STANOIL Industrial Oil. In the Midwest, call your nearby Standard Oil office. Or contact Standard Oil Company, 910 So. Michigan Ave., Chicago 80, Ill.

Bert Richardson (left), Preparation Plant Superintendent, and Fred A. Barnes, Standard Oil lubrication specialist inspect Jones speed reducer at Fairview Collieries. Fred Barnes' customers have found that he is a good man to call in on lubrication matters. Fred has had 18 years' experience providing lubrication technical service to Standard Oil customers. He's a graduate of James Millikin University and of the Standard Oil Engineering School.

STANDARD OIL COMPANY
(Indiana)

STANDARD

Quick facts about STANOIL Industrial Oil

1 **Stability.** STANOIL's antioxidant gives oil resistance to chemical change, minimizes deposits.

2 **Rust Prevention.** Inhibitor in STANOIL "plates out" on metal surfaces prevents corrosion.

3 **Cold Starts.** STANOIL has low pour point. Flows freely from cold start. No need for costly warm ups.

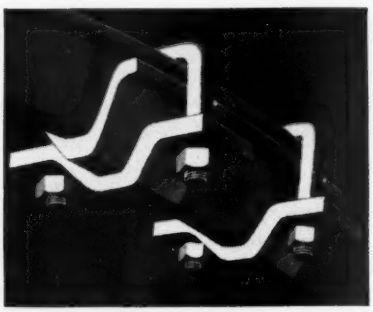
4 **Resists Effects of Temperature Change.** STANOIL has high viscosity index, is resistant to change in both high and low temperature service.

5 **Excellent Demulsibility.** STANOIL is refined to eliminate emulsion problems, contains additive to minimize foaming.

Steel Arch Offers New Kind of Safety Underground

Framing these men as they push the completion of a new ore mine is Bethlehem's Yieldable Arch for mine-roof control. It is especially designed to give rather than deform under excessive pressures. This allows the surrounding strata to stabilize naturally, and contributes to safety underground.

The yielding action takes place at sliding joints, where the nestable segments are joined to form the arch. The drawing at right illustrates how the rolled U-shaped segments nest at points of overlap. Studs on the sides of the segments locate the clamps and keep them positioned as the arch begins to yield.



Husky U-bolt clamps make the connections tightly enough to support normal loads. But when the load on the arch increases, the joints will yield, thus relieving the load while maintaining the structural integrity of the arch.

Horizontal struts and J-bolt clamps tie the arches together and provide lateral rigidity to the structure. Timber lagging may be used if desired, or steel lagging can be furnished.

The Yieldable Arch can be installed by your own men with minimum supervision, and it can be taken down and re-used time and again. It should pay for itself in its first year of operation. One of our engineers will be glad to discuss the Bethlehem Yieldable Arch and its advantages in detail with you. Just say the word.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

the high-profit cleaning process for maximum tonnage of shipping-grade coal

HERE ARE THE REASONS WHY

HMS accurately separates coal from bone on a gravity difference as low as 0.01, regardless of fluctuations in the refuse-content of the raw feed.

HMS duplicates the washability curve of your coal at any gravity you select from 1.25 to 2.50.

HMS handles a full size-range from 3/32" to 8".

HMS requires far less medium make-up than dense-media plants not using the patented HMS medium-recovery and re-conditioning principle.

IN A NUTSHELL

HMS earns a handsome net profit after plant amortization, operating expenses and nominal royalty payments.

American Cyanamid Company is the sole, world-wide technical and sales representative for patented Heavy-Media Separation Processes owned or controlled by American Zinc, Lead and Smelting Company. We will be pleased to give you the benefit of our long experience with these processes and to negotiate a license for their use at realistic royalty rates on behalf of the licensor.

AMERICAN *Cyanamid* COMPANY

MINERAL DRESSING DEPARTMENT

30 ROCKEFELLER PLAZA, NEW YORK 20, NEW YORK

Where parts must be

EXTRA TOUGH

specify AMSCO® MANGANESE STEEL

Digging! Crushing! Handling! Amsco manganese steel parts work up to 10 times longer under punishment . . . because manganese steel can easily absorb heavy impact and abrasion. Hard work toughens the metal . . . it work hardens to as high as 550 Brinell. The pounding, grating action of rock and ore only polishes manganese steel.

To get maximum life out of your equipment, specify Amsco manganese steel parts from the manufacturer.

DIGGING	CRUSHING	HANDLING
dippers and parts	concaves	bulldozer blades
repointers	mantles	tractor rollers, idlers
dragline buckets and parts	jaw plates	sprockets, grouser bars
dragline chain	mill liners	truck beds
sheaves	hammers	grizzle parts
pinions		ore car wheels and liners
crawler shoes		sheaves, gears, pinions

Amsco also produces other alloy steels with maximum wear resistance under particular conditions of service.

AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION

Chicago Heights, Ill.

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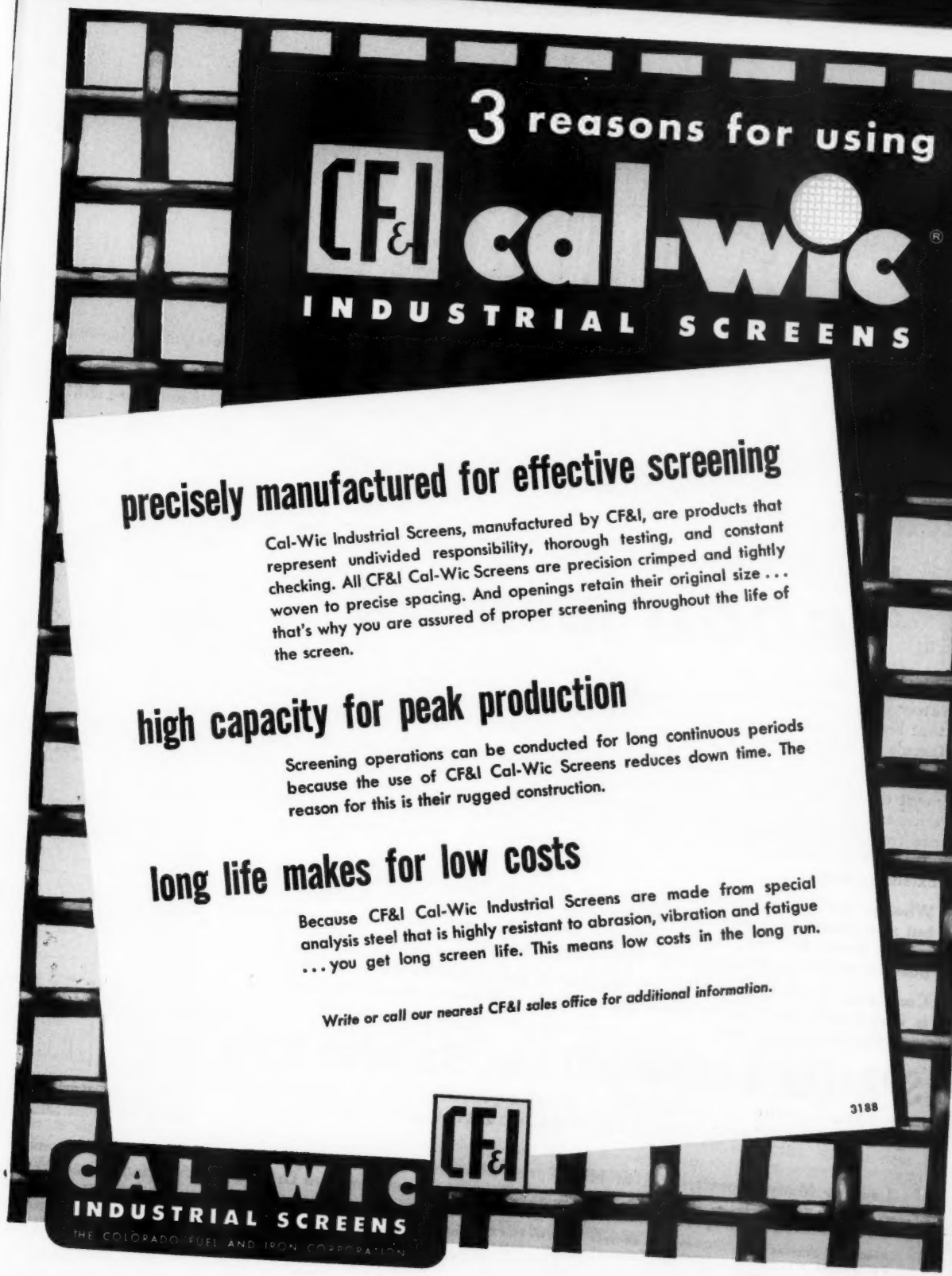
AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION

Chicago Heights, Ill.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CF&I cal-wic®
INDUSTRIAL SCREENS
precisely manufactured for effective screening
Cal-Wic Industrial Screens, manufactured by CF&I, are products that represent undivided responsibility, thorough testing, and constant checking. All CF&I Cal-Wic Screens are precision crimped and tightly woven to precise spacing. And openings retain their original size . . . that's why you are assured of proper screening throughout the life of the screen.
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Screening operations can be conducted for long continuous periods because the use of CF&I Cal-Wic Screens reduces down time. The reason for this is their rugged construction.
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Because CF&I Cal-Wic Industrial Screens are made from special analysis steel that is highly resistant to abrasion, vibration and fatigue . . . you get long screen life. This means low costs in the long run.
Write or call our nearest CF&I sales office for additional information.
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INDUSTRIAL SCREENS
THE COLORADO FUEL AND IRON CORPORATION

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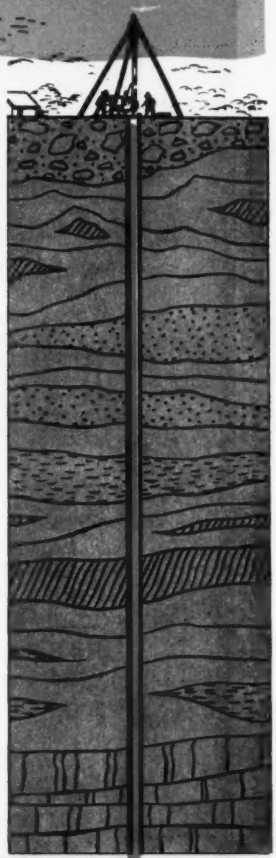
are the most dependable aid to

GOOD MINING



Geological studies, geophysical tests and experienced professional advice—separately or in combination—can tell you quite a lot about that part of an ore body that lies near the surface but when you need to know what's down underground, there's no substitute for a properly planned program of Diamond Core Drilling.

And that's where we come in. The efficient organization and improved equipment developed during more than seventy years of successful world-wide experience enable us to obtain a high percentage of good core from almost any rock or ore formation. Unfavorable conditions are overcome, in many cases, by the use of special tools developed by our own engineers and manufactured in our own extensive shops.

When properly analyzed these good cores not only prove the extent of ore bodies but also permit both physical and chemical examination of the ore that will be mined during the next month, the next year or the next twenty years—your best possible guide to continuously profitable operation.

Compared to the benefits derived, the cost of our exploratory core drilling service is very modest and we welcome opportunities to submit estimates; without charge or obligation of any kind.

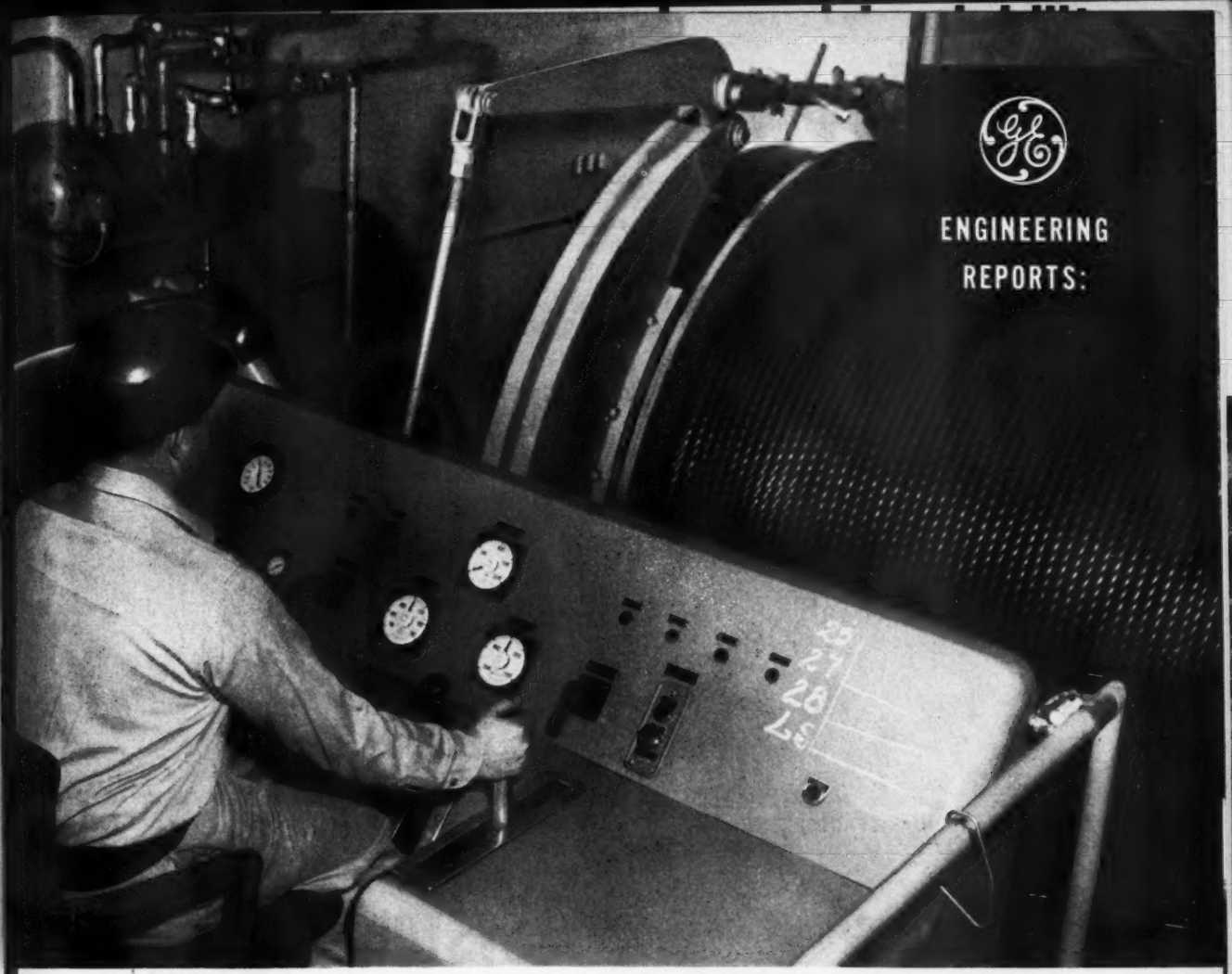
SPRAGUE & HENWOOD, Inc., Scranton 2, Pa.

NEW YORK • PHILA. • PITTSBURGH • GRAND JUNCTION, COLO. • BUCHANS, NFLD.

EXPORT REPRESENTATIVE: PHILIPS EXPORT CO., 100 EAST 42nd ST., NEW YORK 17, N. Y.

Leading Manufacturers, also, of High-Speed Diamond Core Drilling Machines, "Oriented" Diamond Bits and a complete line of Improved Accessory Equipment for Core Drilling and Soil Sampling. Write for illustrated catalogues containing complete specifications and all necessary working data on:

Auger Bits, all types
Bails, lifting
Ball-Bearing Waterswivels
Bits, Diamond
Bits, Blank
Bits, Chopping
Bushings, Rod & Casing
Casing, Flush Coupled
Casing Taps
Clinometers
Corebarrels, all types
Corebarrel Taps
Core Lifters
Couplings, Rod
Derrick Sheaves
Drill Rods
Drilling Machines
Drive Hammers
Drive Heads
Drive Pipe
Drive Pipe Couplings
Drive Shoes
Extensions, Core Barrel
Fishing Tools
Fishtail Bits
Flush Coupled Casing
Foot Safety Clamps
Hoisting Hooks
Hoisting Plugs
Hoisting Plug Reducers
Hoisting Rings
Hose, Waterswivel
Hose, Suction
Jar Lengths
Jaws, Safety Clamp
Lifters, Rod
Mud Bits
Pilot Reamers
Plugs, Hoisting
Pressure Testers
Protectors, Casing
Reamer Shells
Reducers, Rod
Rods, Drill
Rod Couplings
Rod Taps
Rose Bits
Safety Clamps
Sawtooth Bits
Sheave Wheels
Soil Samplers
Subs
Taps, Fishing
Testers, Sample
Testers, Pressure
Wash Plugs
Water Swivels



CUSTOM-BUILT G-E manual or automatic mine hoist drives are available in many types for heavy-duty hoisting.

G-E electrical systems and equipment help you . . .

Mechanize underground mining for more tonnage at lower cost

As market conditions change, underground mines must produce more, faster, and more efficiently, to improve their competitive position. Key to this objective is increased mechanization, with General Electric's help.

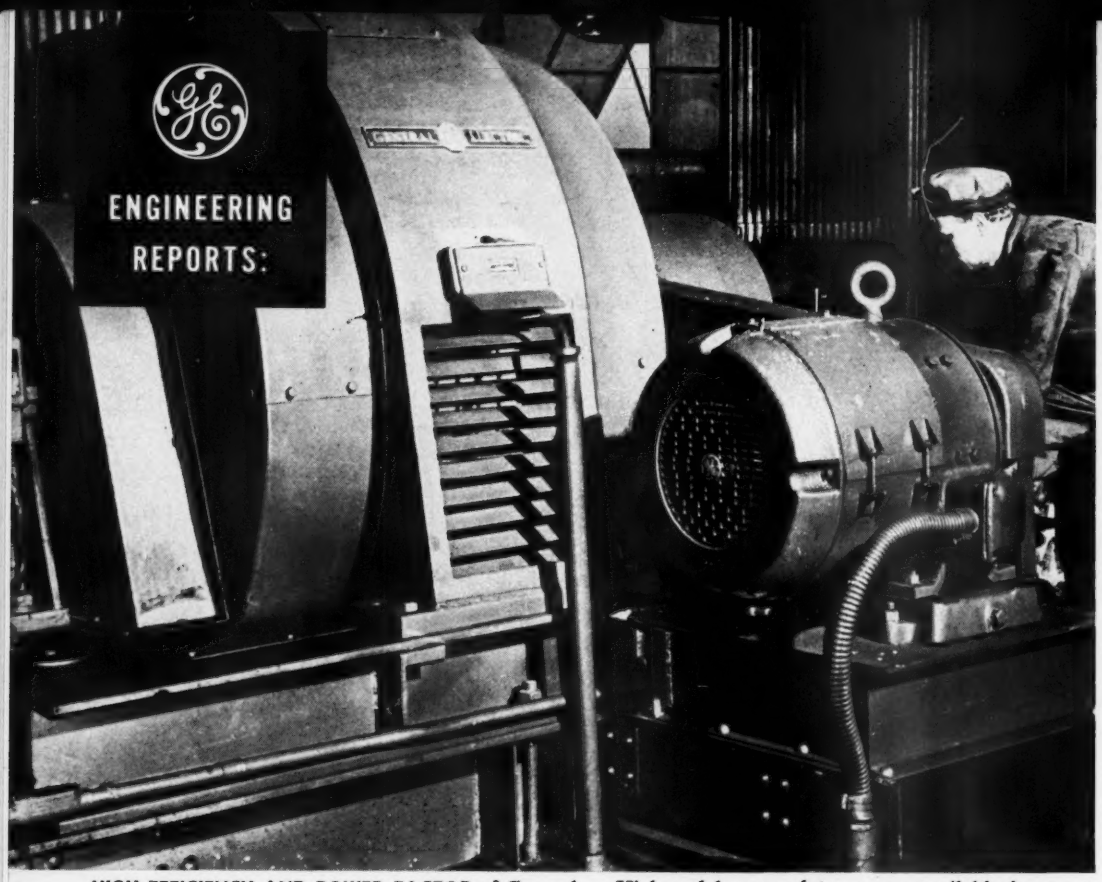
You benefit many ways when you specify G-E electrical systems and equipment. Advantages like these can play an important part in your mine mechanization program:

- **FACTORY-ASSEMBLED** G-E power-system equipment cuts installation time and cost, speeds new construction and start-up.
- **SPACE-SAVING** G-E electrical equipment adapts readily into existing systems, can be expanded easily, at low cost.
- **LOW-MAINTENANCE** G-E drives are designed to last longer, provide more horsepower in limited space, with maximum accessibility for servicing.

TURN PAGE FOR MORE PRODUCT INFORMATION

GENERAL ELECTRIC

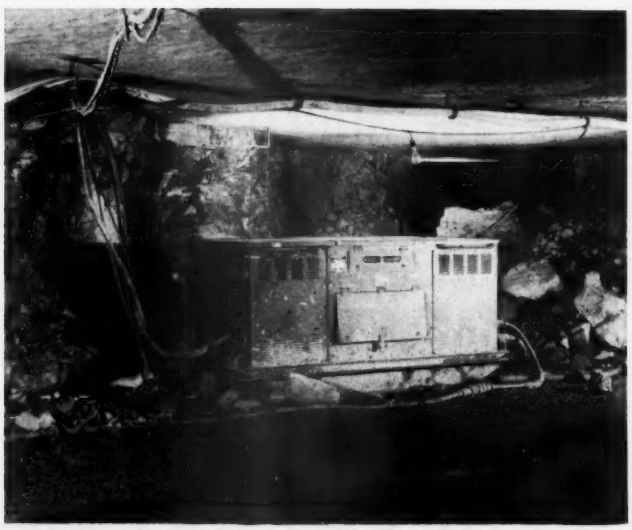
ENGINEERING REPORTS:



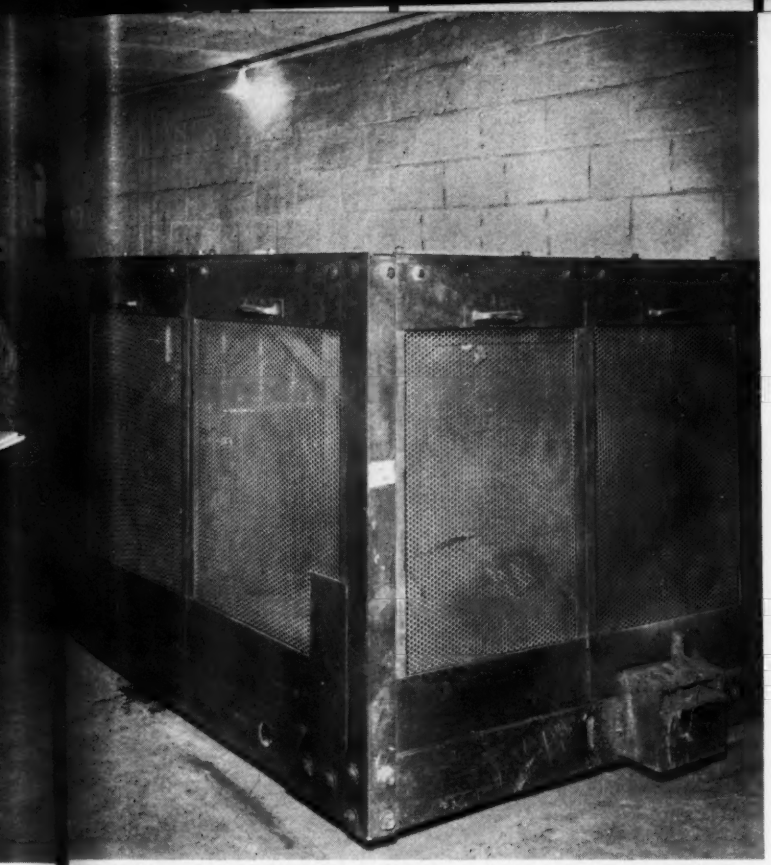
HIGH EFFICIENCY AND POWER FACTOR of General Electric synchronous conveyor or compressor motors cut electrical losses, and can reduce power rate. High and low speed types are available in many sizes, with just the required type starting, pull-in, and pull-out torque.

System-engineered raises efficiency of

CONTINUITY OF PRODUCTION and flexibility of operation are promoted by G-E metal-clad switchgear. Factory-assembled, it is easily installed and maintained.



MORE DEPENDABLE G-E a-c mine power supply, used underground, steps down voltage close to the mining load, minimizing voltage drop, increases the efficiency of your mining machines.



LOW COST CONVERSION of power is obtained with portable G-E mining-type mercury-arc rectifiers. Move easily as face advances. Absence of major rotating parts reduces wear, shutdowns.

SPECIALLY DESIGNED for service reliability, rugged G-E totally enclosed fan-cooled Tri-Clad* motors are also available in design approved by Bureau of Mines.

G-E equipment underground mining

Modern General Electric equipment can give you the speed, flexibility and safety you need for more efficient underground mining. G.E. can also help in these ways:

Latest electrical techniques are employed by G-E application engineers, working closely with you or your consultants, to give you the most flexible and lowest-cost system for your mining needs.

Extensive developmental facilities are constantly used by G-E product engineers in providing new and improved products to help you increase mining output and efficiency.

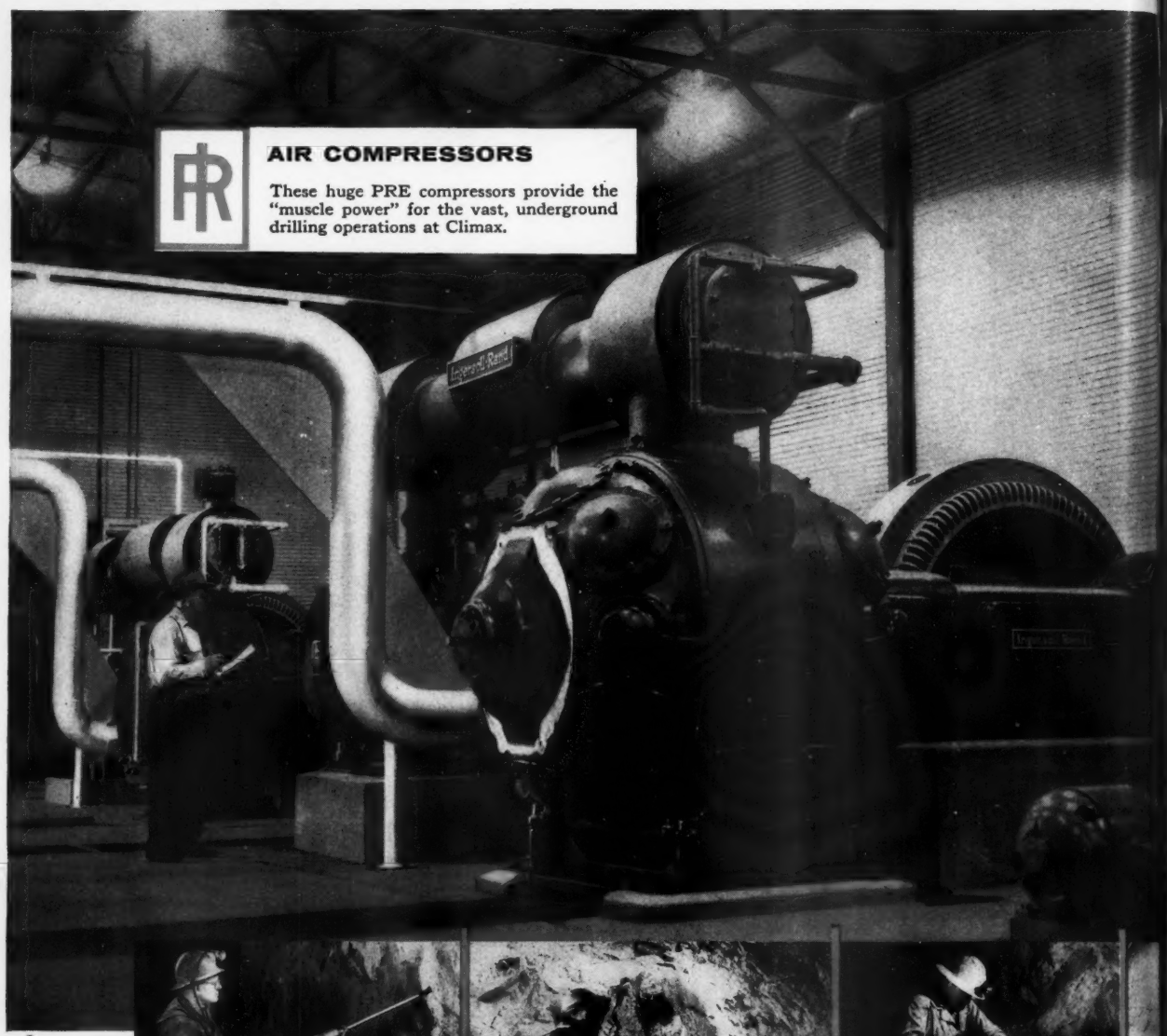
From early plans through start-up, G.E. can coordinate selection, delivery and installation of all your electric equipment, saving you engineering time and construction costs. For more information, contact your nearest G-E Apparatus Sales office, or write General Electric Co., Schenectady 5, N. Y. 660-33

HIGH AVAILABILITY of G-E mine locomotives cuts costs. G.E. offers a variety of types which handle easily, efficiently, and help speed all haulage in underground mines.

*Reg. trade-mark of General Electric Co.

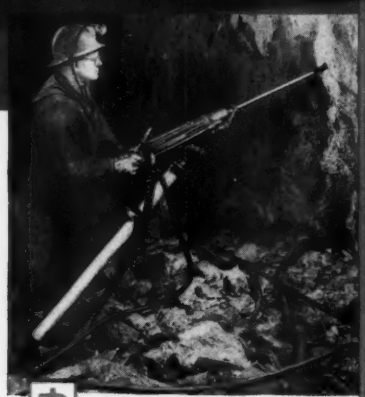
Engineered Electrical Systems for Underground Mining

GENERAL ELECTRIC



AIR COMPRESSORS

These huge PRE compressors provide the "muscle power" for the vast, underground drilling operations at Climax.



JACKDRILLS

Versatile, light-weight JR-38 Jackdrills save setup time and permit quick spotting of holes for drilling in practically any position.

STOPEHAMERS

These husky, hard-hitting stopers maintain consistently high drilling speed for all types of up-hole work.

JACKHAMERS

For down-hole and secondary drilling, the easy-handling J-40 Jackhamer is a big saver of time and effort.

Everything you need for drilling rock—from the compressor

DRILLING POWER AT Climax

North America's largest underground mine maintains top efficiency with I-R equipment

It takes plenty of *drilling power* to mine 8½ million tons of molybdenum ore per year. And to achieve this annual production on a profitable basis requires top efficiency of all equipment, from the cutting face all the way back to the compressor station.

That's why we at Ingersoll-Rand take pride in the vital role which I-R equipment has played in the successful operation of Climax Molybdenum Company's huge Climax mine. Here I-R rock drills, Carset Jackbits, air compressors, air hoists, bit shop equipment and centrifugal pumps helped to turn out 73% of all molybdenum produced by the free world in 1954.

CARSET JACKBITS

Carsets have become the standard of drilling speed and economy at Climax — because they maintain their high cutting efficiency for hundreds of feet of hole.

BIT SHOP EQUIPMENT

Cut-off machines, drill steel furnaces, sharpeners and draw furnaces keep drill steels in shape for top performance.

AIR HOISTS

These powerful utility hoists are widely used for hauling ore cars up grade and operating scraper equipment.

14-270

to the Carset Jackbit

Ingersoll-Rand

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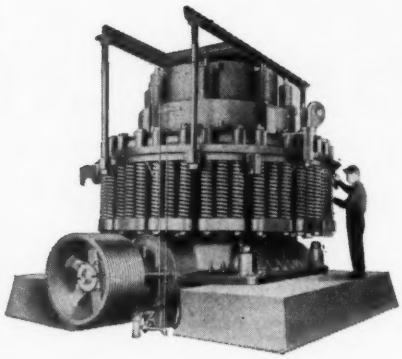
SYMONS® PRIMARY GYRATORY CRUSHERS... Built in sizes from 30" to 72" feed openings to meet any desired production operation.

SYMONS CONE CRUSHERS... The machines that revolutionized crushing practice. Built in sizes from 22" to 7' diameter heads with a wide range of capacity.



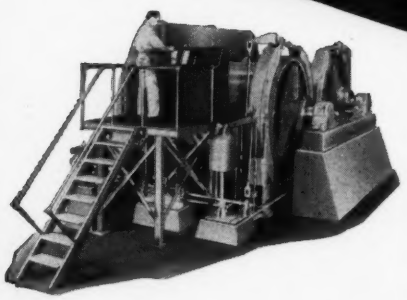
NORDBERG MACHINERY for the MINING INDUSTRY

For base metals...precious metals ...the rarer elements...non-metallics and minerals . . . NORDBERG MACHINERY is the outstanding choice of producers in the mining industry the world over.

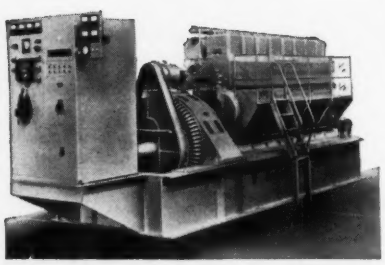
More than half a century of progressive engineering achievement, combined with quality production, in unexcelled manufacturing plants, have firmly established Nordberg's leading position in the field of heavy machinery design and construction.

Nordberg Machinery assures maximum and continuous production at low operating and maintenance cost. For full details, write for literature on the machinery you need.

NORDBERG MFG. CO.
Milwaukee, Wisconsin

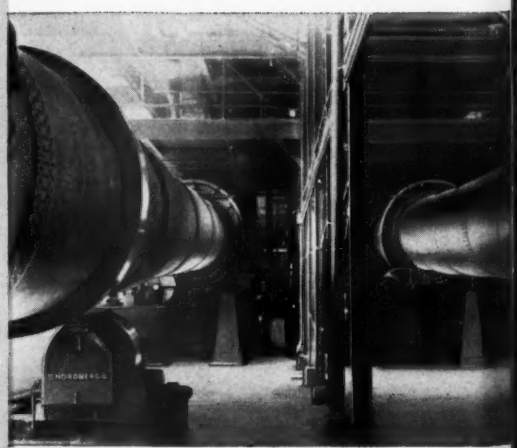


NORDBERG MINE HOISTS... As the source of the most progressive hoist engineering advances in the mining industry, Nordberg has held worldwide leadership in the hoist field since 1895.



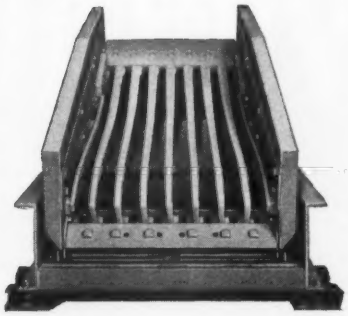
NORDBERG ENGINES . . . For oil, gas or Duafuel® operation. Built in sizes from 10 to over 10,000 horsepower to meet practically all power requirements.

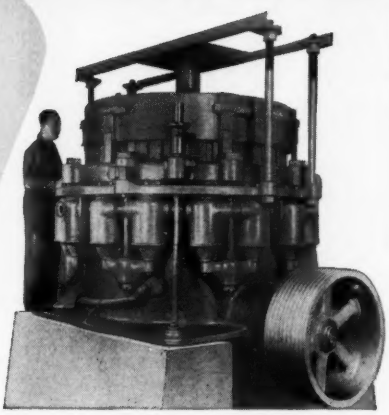
NORDBERG KILNS — DRYERS and COOLERS... To meet a wide range of requirements, including pyro processing operations, drying, calcining burning and cooling.



NORDBERG GRINDING MILLS . . . Ball, tube, rod and compartment types, for wet or dry, open or closed circuit operation.

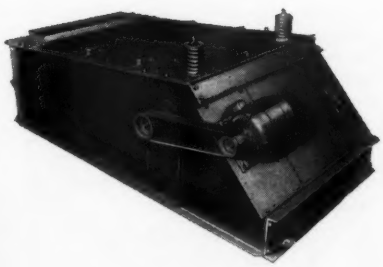
SYMONS VIBRATING GRIZZLIES . . . Built in bar and rod types for effective heavy duty scalping service handling feed sizes up to 30" and larger.





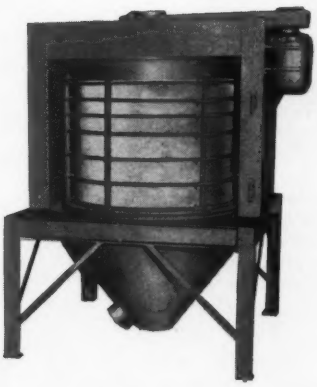
NORDBERG GYRADISC CRUSHER . . . A revolutionary machine for the production of large tonnages of extremely fine product.

SYMONS HORIZONTAL VIBRATING SCREENS . . . Level position assures extreme accuracy in sizing, requires less headroom, permits easy installation.



SYMONS ROD DECK SCREENS . . . Highly efficient screening surface of spring steel rods—easily replaced. Especially suited for wet, sticky materials.

SYMONS "V" SCREENS . . . For extremely fine, single cut wet or dry separations. Employs controlled diffused feed and vertical flow of material.



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M155

NORDBERG MACHINERY

NORDBERG

MACHINERY FOR PROCESSING ORES and INDUSTRIAL MINERALS

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SYMONS . . .

A REGISTERED NORDBERG TRADEMARK KNOWN THROUGHOUT THE WORLD

VICTAULIC METHOD OF PIPING

VICTAULIC COUPLINGS

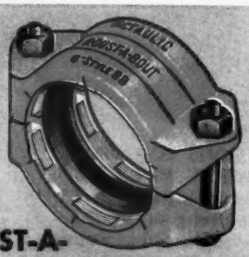
Styles 77, 77-D for standard applications. Simple, fast to install—sturdy and reliable. Sizes ¾" to 30". Style 75 Light-Weight Couplings for light duty applications. Sizes 2", 3", 4". Additional styles for cast iron, plastic and other pipes. Sizes through 60".

VICTAULIC FULL-FLOW FITTINGS

Complete line of Elbows, Tees, Reducers, Laterals, etc.—to fit all Victaulic Couplings. Streamlined for top efficiency, easy to install. Sizes ¾" to 12".

VIC-GROOVER TOOLS

Handy, on-the-job grooving tools that do the work in half the time. Light weight, easy to handle—operate manually or from any power drive. Automatic groove position and depth. Sizes ¾" to 8".



ROUST-A-BOUT COUPLINGS

Style 99 for plain or beveled end pipe. Best engineered, most useful plain end joint on the market. Simple, husky — easy and fast to install. Takes strong bull-dog grip on pipe. Sizes 2" to 8".

VICTAULIC SNAP-JOINTS

Victaulic's new boltless, speed coupling. — Style 78 — hinged into one assembly. Hand-locks for time and dollar savings. Sizes 1", 1¼", 2", 3", 4".

EASIEST WAY TO MAKE ENDS MEET

Promptly available from distributor stocks coast-to-coast. Write for NEW Victaulic Catalog-Manual 55-9D

VICTAULIC COMPANY OF AMERICA

P. O. Box 509 • Elizabeth, N. J.

INDUSTRIAL HOSE AND FITTINGS

Super resistance to abrasion and corrosion makes this hose excellent for railroads, road equipment, farm machinery, and materials handling equipment. High tensile strength single wire braid. Tough synthetic rubber cover. Working pressures to 2500 psi. Bulk hose and fittings . . . complete hose assemblies at your dealer.

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Dealerships open in some areas.

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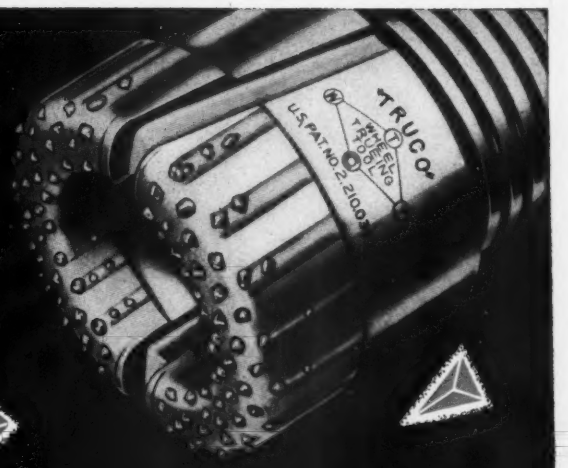
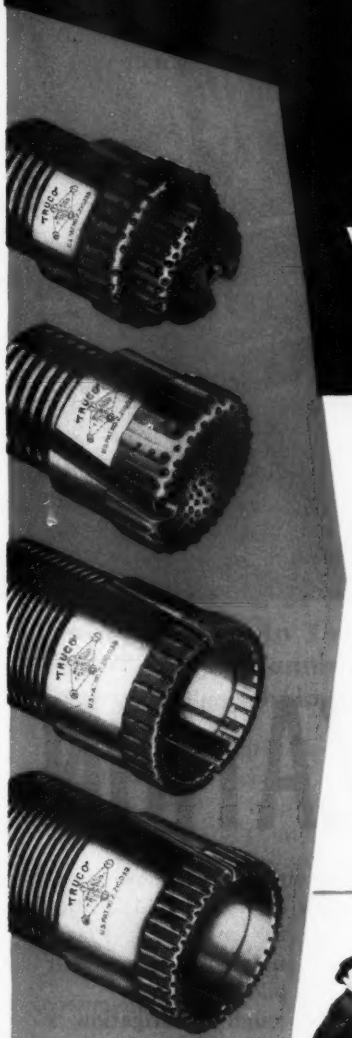
How to take a "Ribbing" and like it!





with TRUCO Diamond Bits

Truco Diamond Bits and Reamer Shells are "ribbed" where it counts most. Each diamond, because of its natural structure, has a distortion which is known as the "rib" or hard vector and which is the hardest cutting edge on this best of cutting materials. In each Truco bit or shell, the diamonds are set in such a way as to turn this rib into the work. This enables the bit to cut faster and last longer, to give you maximum footage at minimum cost.

This hard vector setting, combined with Truco's "pattern" setting, which puts each diamond where it will do the most good, makes Truco bits and reamer shells the best bet for decreasing your drilling costs. ● Why not find out more about them today? Write ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario*

SPECIAL NOTE: **Fast, expert Diamond Resetting Service by Joy helps to decrease your drilling costs! Joy service keeps diamonds at work as much of the time as possible . . . gives maximum salvage value . . . permits resetting in patterns suggested by extreme wear on returned bits.**

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"DO'S and DONT'S" for DIAMOND DRILLING

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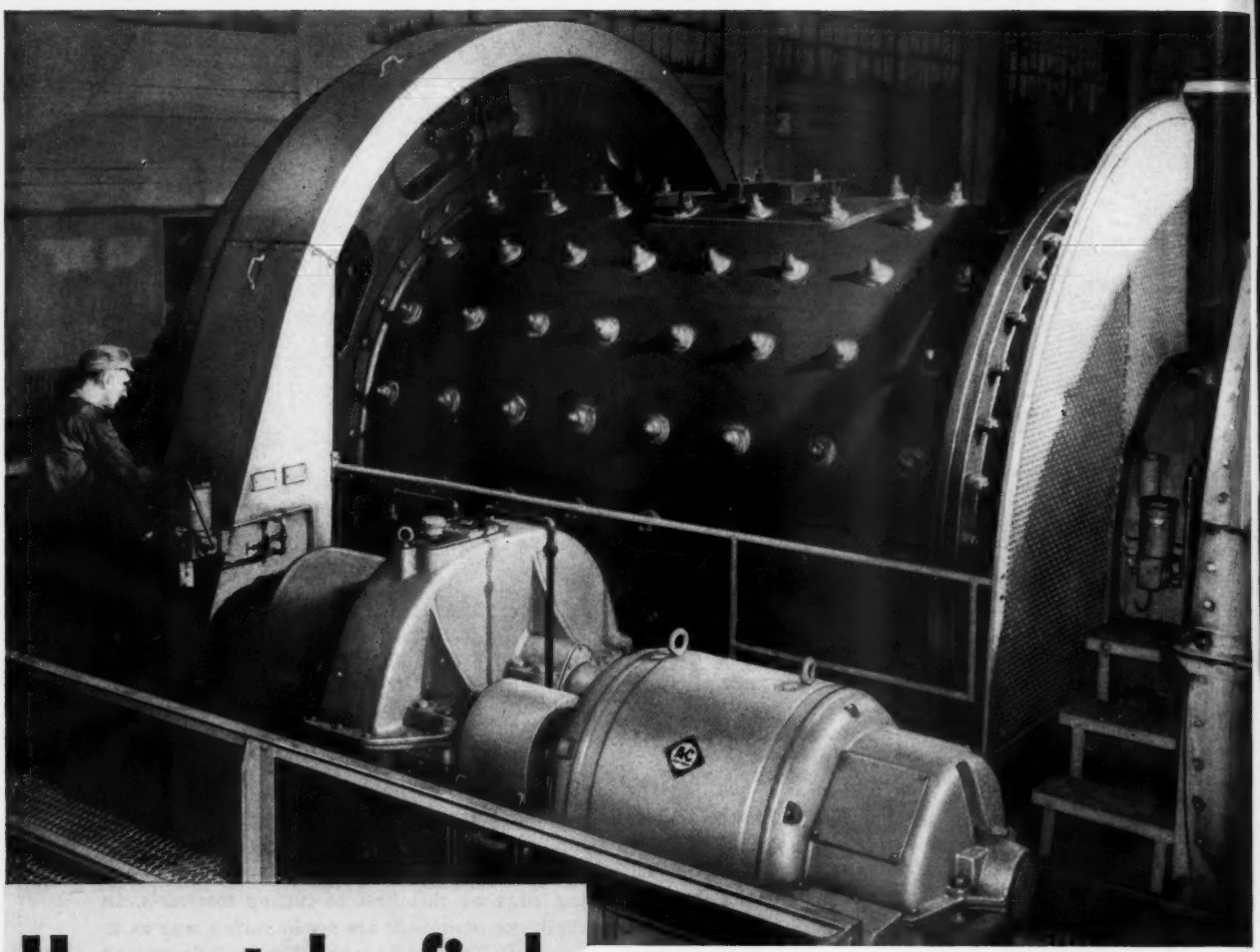
WORLD'S LARGEST MANUFACTURER OF CORE DRILLS AND MOTORIZED DRILL RIGS SINCE 1851



Homestake finds Gold in MODERNIZATION

Industry's Top Technical Team Helps Reduce Operating Costs

A 2.25 kwhr saving per ton in power consumption — a 37½% reduction in operating labor—a similar saving in maintenance and supply work — considerable space conservation. These benefits realized by Homestake Mining are gilt-edged proof that modernization pays.

Pressured by increasing labor and material costs, in the face of a fixed price on gold, Homestake took a long, hard look at its gold ore operation. With the *help of Allis-Chalmers,* the Homestake staff made a comprehensive study of all phases of ore treatment. Crushing and grinding flow sheets were drawn up and costs estimated. Machines were operated under varying conditions. Power measurements, product analyses and man-hour appraisals were made in a pilot plant run.

As a result of this thorough investigation, a modernization program was launched in each of Homestake's two crushing plants and mill. New equipment was installed and procedures modified to make existing equipment as efficient as possible. Two years of profitable operation have proved that Homestake Mining has struck a rich vein in modernization. A-4470

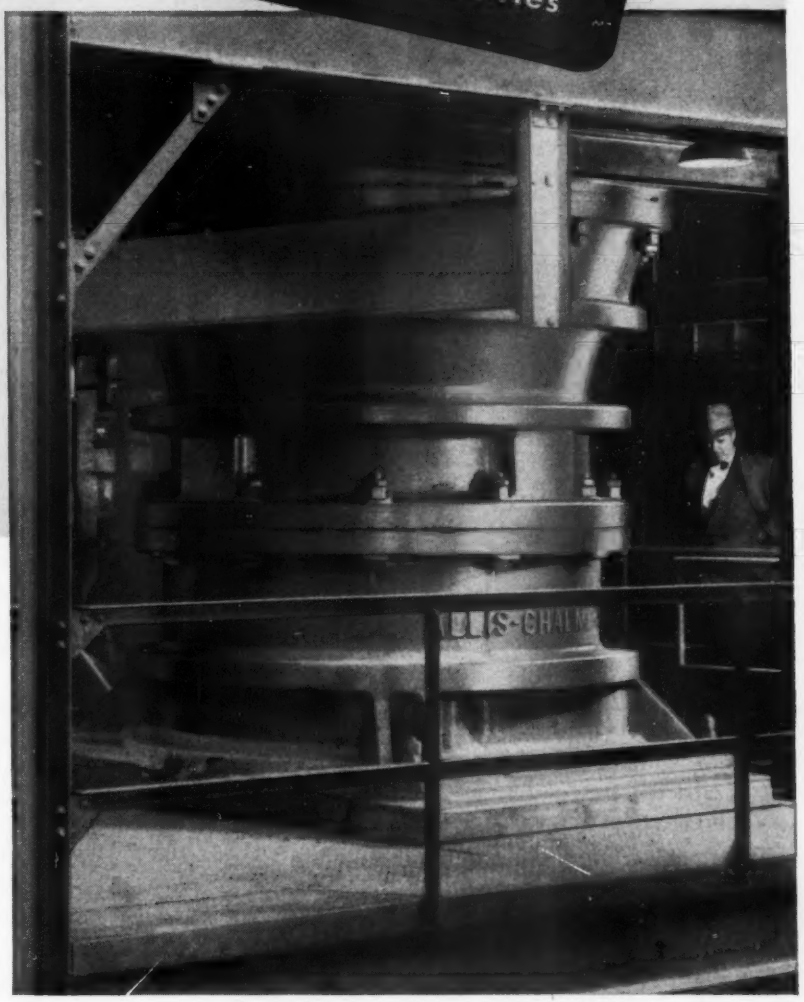
ALLIS-

Prominent in the modernization picture at Homestake are three 9 by 11-foot Allis-Chalmers ball mills. These mills, used in the amalgamation process, are equipped with combination drum and double-scoop feeders. Liners are of the Lorain type with hardened lifter bars. Ball additions are 1½ to 2 inches. The mills are driven by 450-hp, 1200-rpm Allis-Chalmers motors through speed reducers.

In each of Homestake's two crushing plants, a modern 30 — 55 *Superior* gyratory crusher has replaced two outmoded 17-inch primary crushers. The new crusher outproduces the combined tonnage of the old crushers and takes up less than half the space. The wearing quality of manganese steel mantles and the strength of short, rigid mainshaft have cut maintenance and parts replacement costs.

Superior is an Allis-Chalmers trademark.

ALLIS-CHALMERS
Equipment for the
Mining and Rock
Products Industries



For as Much Help as You Want or Need in Your Modernization Planning, Contact Allis-Chalmers

Your A-C representative, backed by industry's top technical team, is always ready to help you or your consultants. A-C interest in your problems does not end with the installation of equipment. Laboratory facilities, periodic checkups, maintenance and fast emergency parts service are yours continuously.

Crushers—all types
Vibrating Screens—all types... Grinding Mills—all types
Kilns... Coolers... Washers... Dryers... Smelting Equipment

CHALMERS

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For complete information, call your Allis-Chalmers district office or write Allis-Chalmers, Milwaukee 1, Wis.

In Minnesota . . . And the World Over

BUCYRUS-ERIE WARD LEONARD ELECTRIC SHOVELS

Help Put The Lid On Rising Costs

This Bucyrus-Erie 190-B shovel is stripping overburden in a Minnesota iron mine.

In every design and construction feature Bucyrus-Erie Ward Leonard electric shovels are built to save you money. They have the capacity and performance ability to deliver high output at an economical cost per yard.

Modern front-end design eliminates dead weight, lets power work effectively swinging payloads. Boom strength is greatest where it's needed most to withstand digging and swinging stresses. Ward Leonard control results in fast acceleration and deceleration, provides extra torque and ample usable power. Heavy-duty construction keeps maintenance costs down and adds years to machine life.

All over the world — in mines, in quarries, and on big construction projects — Bucyrus-Erie Ward Leonard electric shovels are being used to handle the toughest digging and loading assignments. Those who use them know that Bucyrus-Eries, with their fast operating cycles and durable construction, provide the dependable high-output and low-cost performance that means profitable operation.

61L55

BUCYRUS-ERIE COMPANY

1880 South Milwaukee, Wisconsin 1955

75 Years of Service to Men Who Shape the Earth

ELIMINATE TIME-WASTING DRILL STEEL CHANGES!

You can quickly interchange both TIMKEN® rock bit types on the same drill steel—right on the job

TIMKEN® multi-use and carbide insert bits eliminate the time wasted in going after a different set of steels whenever bit types are changed. Timken rock bits are interchangeable. Dozens of different bits fit the same drill steel. And it takes only a minute to unscrew one type of Timken rock bit and screw a different type bit on the same drill steel.

With Timken rock bits, your men can quickly switch to the most economical bit as the ground changes—right on the job. And because dozens of different Timken multi-use and carbide insert bits fit the same drill steel, you don't have to carry a large drill steel inventory.

Both Timken multi-use and carbide insert bits are made from electric furnace Timken fine alloy steel. And their special shoulder union keeps drilling impact from damaging the threads.

If you have a drilling problem, call our rock bit engineers. They'll be glad to help you. And there's no obligation. Just write: The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".

WHERE YOU CUT COSTS WITH TIMKEN MULTI-USE BITS

Most economical for ordinary ground. With correct and controlled reconditioning, they give lowest cost per foot of hole when full increments of steel can be used.

WHERE YOU CUT COSTS WITH TIMKEN CARBIDE INSERT BITS

Give highest speed through hard, abrasive ground. Also most economical for constant-gauge holes, small diameter holes, very deep holes.

... your best bet for the best bit... for every job

TIMKEN

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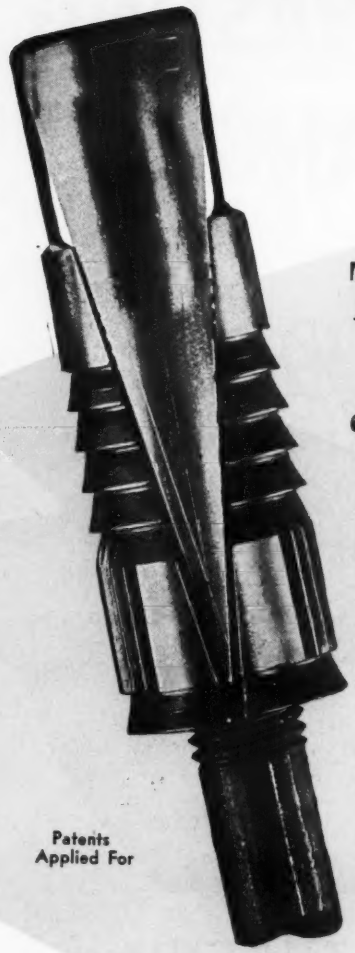

Patents Applied For

THERE'S A BIG DIFFERENCE IN "Before-Bolting" and "After-Bolting" PRODUCTION COSTS AND SAFETY RECORDS

From reports (covering periods from 6 months to 2 years) of mining companies that keep strict recordings of production costs and safety—the real story of the advantages of roof bolting is told in the following excerpts taken from their reports—

"we have doubled our section output"—"our direct mining costs have been reduced about 20c per ton"—"have had production increase of 4 tons per man at the face"—"our average tons per man has increased between 10% and 20%." All reported that bolting "greatly improved the mine's safety record." As most mines could derive similar benefits—bolting should justify management's consideration and testing.

Being the largest exclusive manufacturer of roof bolting products—PATTIN Manufacturing Company has the largest and most complete line of outstanding shells, bolts, etc. Our roof bolting experts are available for consultations and tests. Write or phone us at your convenience.

Shown above is the PATTIN style D-1 expansion shell. Samples of the "D-1" or "D-2" will be furnished upon request.

In Western States

PATTIN expansion shells are available and serviced exclusively through MINING SUPPLY SALES, Denver, Colorado—a division of The Colorado Fuel and Iron Corporation. Western mining companies may contact them direct for information and consultation.

PATTIN *"The Pioneer in Roof Bolting"*

PATTIN MANUFACTURING COMPANY

"67th Year"

MARIETTA, OHIO

THERE'S A NATIONAL BRUSH GRADE FOR EVERY MINE AND MILL APPLICATION!

TRADE-MARK

Anywhere you use a "National" brush, you can be sure of top performance, but to get *maximum* benefit from the complete "National" brush line, apply it *everywhere* you can.

Only the "National" brush line offers proved, top-performance grades for such a wide range of mine and mill applications . . . together with experienced technical advice on the grade best suited to each motor or generator.

Long life, good commutation, low maintenance and uniform quality – they're all built into every "National" brush you use. Why not save additional time and money in brush selection, ordering and handling? Specify "National" brushes *all through your mine or mill.*

The term "National", the Three Pyramids Device and the Silver Colored Cable Strand are registered trade-marks of Union Carbide and Carbon Corporation

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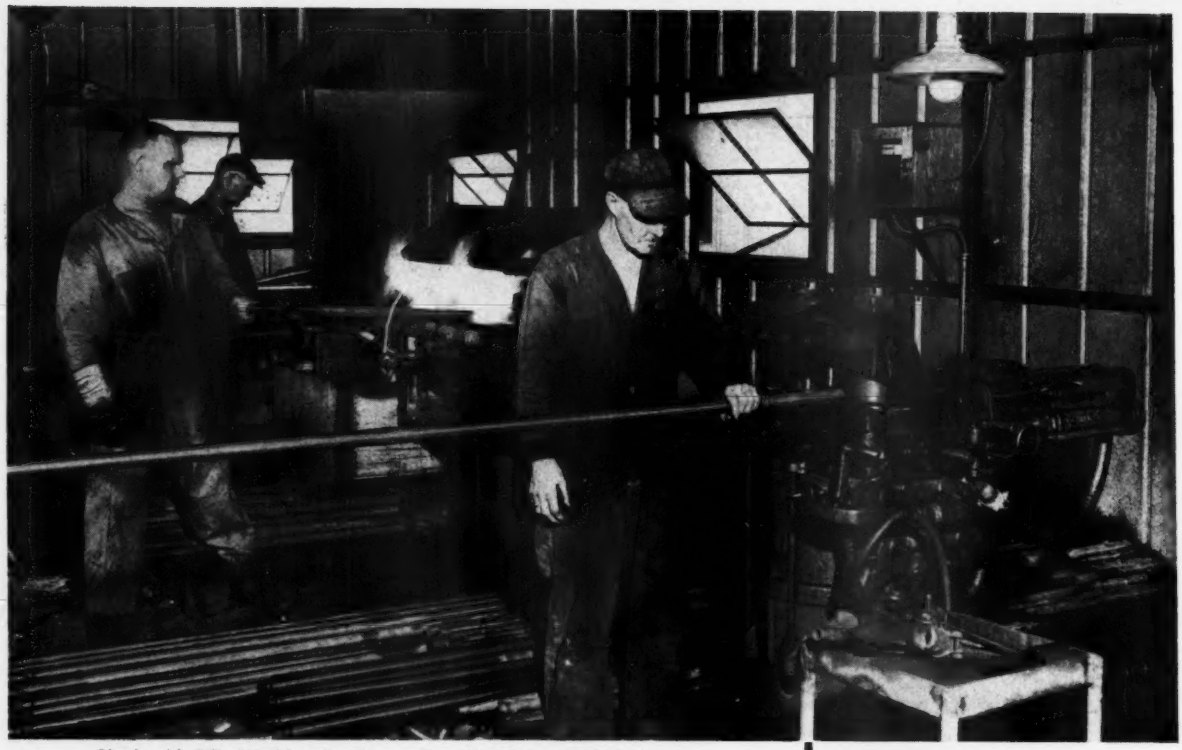


Blacksmith Billy Watkins shanking a Crucible Hollow Drill Rod.

they're using Crucible Hollow Drill Rods on the Boston Tunnel Jobs . . .

400-feet below the city of Boston, two seven-mile tunnels are being cut through solid rock. Replacing century-old mains, the tunnels will bring water from Quabbin Reservoir, 70 miles away, and remove drainage from the city.

On this job, like most other tough ones, Crucible Hollow Drill Rods are in daily use. For experienced construction men *know* they can depend upon Crucible Hollow Drill Rods for top performance at *lowest cost per foot of hole drilled.*

That's because they are made to *tool steel* standards by the nation's leading producer of *special steels.* So for *extra* dependability on *all* your drilling jobs specify Crucible Hollow Drill Rods. *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 30, Pa.*

120-foot-high head frame used to raise and lower men and materials in excavation shaft. Morrison-Knudsen-Kiewit-Maney City Tunnel Extension Job, Boston, Mass.

CRUCIBLE first name in special purpose steels

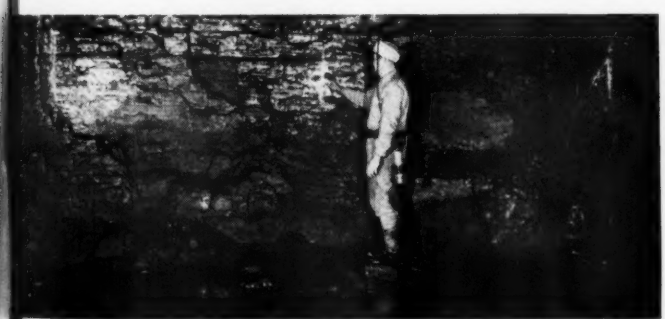
Crucible Steel Company of America

"We get coarse coal, good loadability with 'Monobel' AA—even in a wet mine"

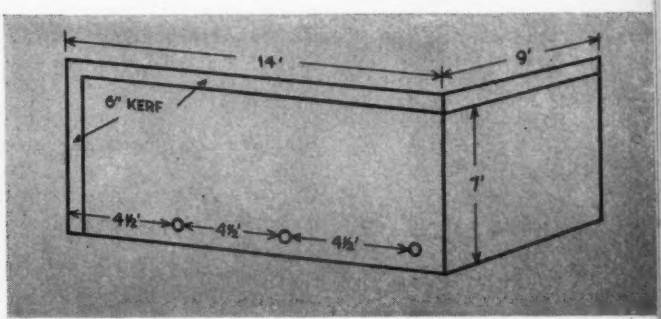
. . . Report M. J. Weber, Vice President, and Arthur B. Ord, Superintendent, Barnes-Dawson Coal Co., Dawmont, W. Va., subsidiary of Bird Coal Co., Philadelphia, Pa.

"Many places in our mine are wet and any mine owner knows that usually spells trouble. But 'Monobel' AA has consistently given us top performance—high percentage of coarse coal, good loadability, smooth rib-shearing action—without regard to wet or dry conditions. This helps us maintain production at a standard level. We can count on 'Monobel' AA for an excellent job at *all* times."

SUPERINTENDENT ORD tests for gas amid a fall of firm, coarse coal. The low velocity heaving action of "Monobel" AA throws the coal within easy reach of mechanical loaders. The small percentage of fines allows quick, efficient cleaning. The good fumes permit a speedy return to the working place.



SAME ROOM cleaned up and made ready for cutting and drilling. "Monobel" AA has sheared the back and rib smoothly. Its high water resistance is a big advantage in this mine.



ALL ROOMS are top-cut and sheared on the left rib. Technical service men from Du Pont helped develop this efficient shooting pattern. Let specially trained Du Pont men assist you with your shooting difficulties.

Whether your problem is a wet mine, excessive fines or thick "middleman"—Du Pont "Monobel" AA provides the solution. If you want flexibility of use in a wide variety of situations, test "Monobel" AA now. Many other mine owners have let "Monobel" AA help them. The result: "Monobel" AA is the largest-selling permissible in the world. For complete information contact the Du Pont explosives representative in your area or write E. I. du Pont de Nemours & Co. (Inc.), Explosives Dept., Wilmington 98, Delaware.

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Blasting Supplies and Accessories

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BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

$108 Saved Each Working Day On Trip Riders Alone . . . . .

How Much Would The Advantages Below Save You?

REGENT SLOPE MINE SAYS:

- "We'd need at least six trip riders—if we didn't have O-B Couplers—at about eighteen bucks a day per man."
- " . . hasn't been one coupling accident in this mine since we got O-B Couplers over six years ago."
- "Maintenance of O-B Couplers is several times less than that of any other type of coupling I've ever had experience with."
- "We don't have any runaway cars or broken trips."
- "We save valuable time the way O-B Couplers automatically couple on contact. No hands needed."

Ohio Brass

MANSFIELD OHIO, U. S. A.

IN CANADA: CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

Feeder and Trolley Materials • Control Materials • Trolley Shoes
Roof Bolt Shells and Plugs • Rail Bonds • Automatic Couplers

4497-AM

Use this Wire Rope on your toughest mining job—it's made to meet your needs!

Wherever you use Wire Rope—for scraper loaders, mine hoists, draglines, strip shovels, on mining machinery—you'll find MONARCH WHYTE STRAND Ropes have the toughness and flexibility to give you longer heavy-duty service at lower cost. These Ropes are *designed* to serve well under the toughest going—built to *fit your* needs and service conditions.

MONARCH WHYTE STRAND wire ropes have all the quality features it takes to give you outstanding service. They are supplied PREformed and Internally Lubricated to resist abrasion, corrosion, and internal friction. These Macwhyte Mining Ropes are available in every wire rope classification.

Macwhyte makes a thousand and one types, sizes, and grades of WHYTE STRAND wire rope. This assures a right rope for every mining use and service condition. Put WHYTE STRAND on *your toughest jobs—and see for yourself!*

MACWHYTE MINING ROPE

MACWHYTE COMPANY, 2952 Fourteenth Avenue, Kenosha, Wisconsin

Manufacturers of: Internally Lubricated PREformed Wire Rope, Braided Wire Rope Slings, Aircraft Cables and Assemblies, Monel Metal and Stainless Steel Wire Rope Assemblies.

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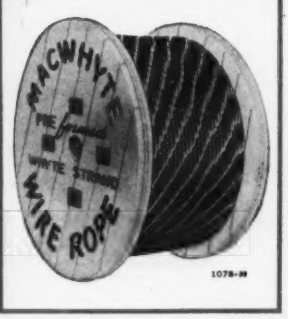

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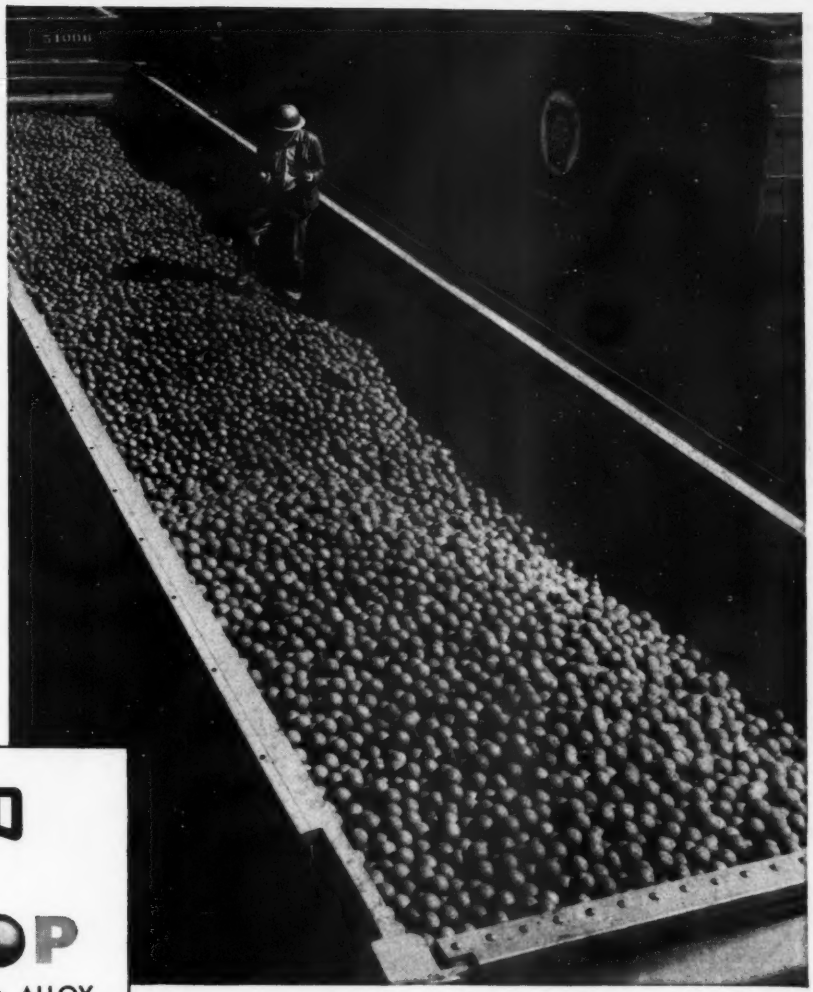

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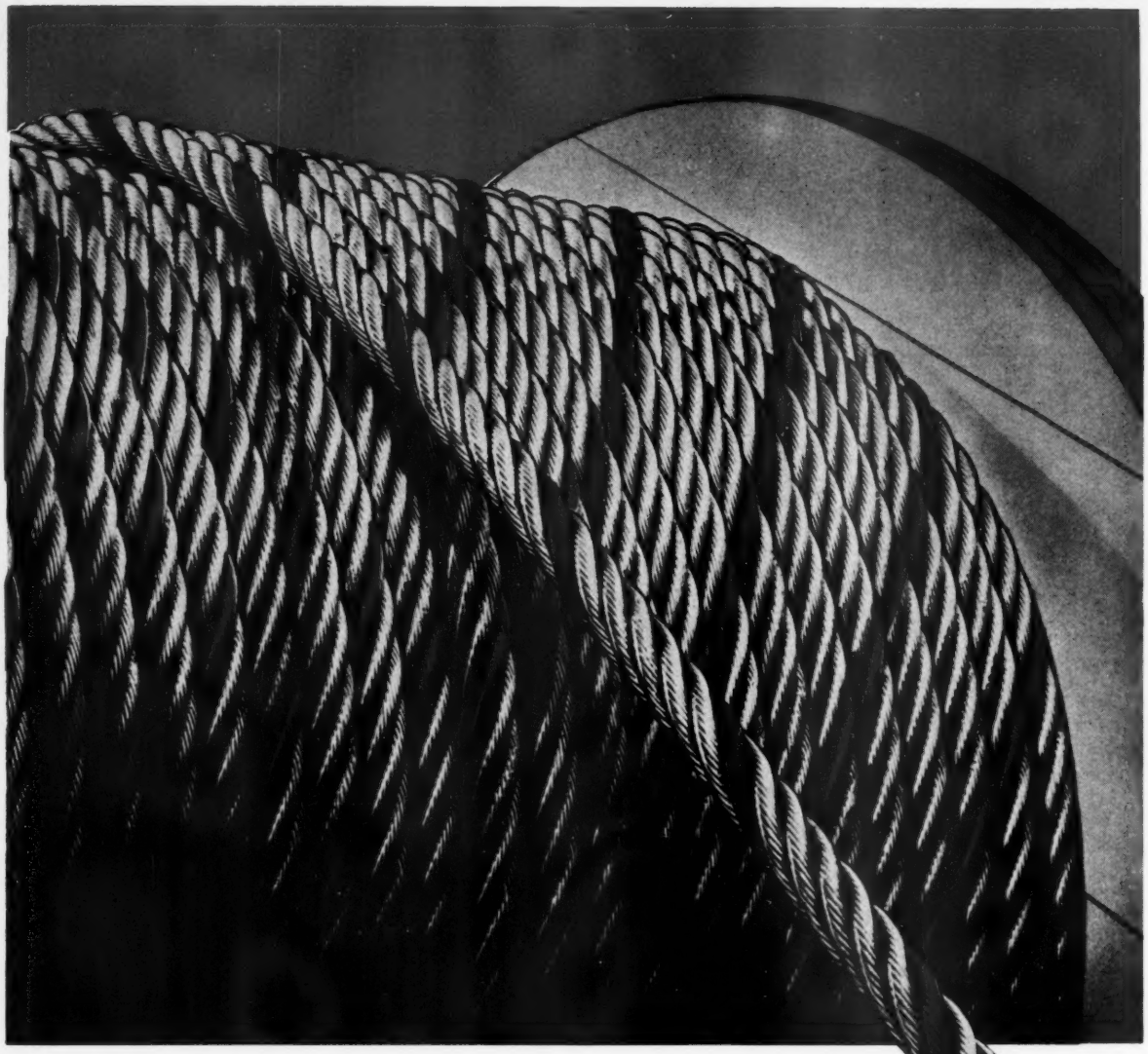

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Mining
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Great Is Truth

IN the Old Testament, one will find these words: "Great is truth, and mighty above all things."

These words aptly describe the conduct of Howard I. Young in upholding his beliefs. Subjected to vicious attacks by those who would impugn his honesty, integrity and his desire to serve his country well, he followed the precept that when a man knows the truth and speaks the truth, his fellow men will listen, admire him for it and judge him fairly.

During the Korean War Mr. Young answered his country's call for the second time within the last decade and came to Washington to serve as Deputy Administrator of the Defense Materials Procurement Agency. This agency, known throughout the mining industry simply as DMPA, was charged with the expansion of production and procurement of some 40 different metals and minerals for the national defense program—a program with high goals, for no one at that time knew whether or not the Korean episode might broaden into World War III.

One of the metals involved was zinc. The company which Mr. Young heads is a producer of zinc and during his Government service, which was without compensation, he retained his position as president of his company. It was in connection with the processing by the Defense Materials Procurement Agency of Government contracts with three zinc mining companies that the General Accounting Office raised a question of possible "conflict of interest" between Mr. Young's position as a DMPA official and his private position as head of his company.

A report of the General Accounting Office containing various allegations was made public on the Senate floor and was widely quoted in the press before Mr. Young was even made aware of the contents of the report, and before the appropriate Committee of Congress had had a chance to hear his side of the story. Thus Mr. Young was publicly pilloried before being given the opportunity to answer the charges against him and to demonstate that they were based upon faulty or incomplete information. He was denied the courtesy due any American citizen, of being notified as to any criticisms of his public acts and afforded the opportunity to refute them before they were made a matter of public record.

Fortunately, Mr. Young is a real fighter and immediately sought vindication of his record. He went before the Joint Defense Production Committee of the United States Congress. He used the sword of truth to slash away the erroneous and misleading statements and inferences in the GAO report. The record of his testimony, which has been made public, shows that the truth stands "mighty above all things." Mr. Young denied the allegations of the General Accounting Office and when his sincere and well-documented testimony was heard, prominent committee members were convinced that the GAO had been derelict in its duty to seek out and make known the whole truth. The halls of Congress rang with demands that those who prepared the General Accounting Office report should themselves be subjected to investigation.

The distinguished chairman of the Joint Defense Production Committee took occasion to declare on the floor after the hearing that, in his opinion, Howard Young was a man of good character and had the General Accounting Office talked with Mr. Young there probably would have been no hearing. Members of both political parties attested to his high character and reputation, praising his forthright testimony which had clearly vindicated him. Ultimately, the Comptroller General, who heads the General Accounting Office, assured the public that he had no reason to think that Howard Young did not believe he had acted in good faith and had well served his country while in the Defense Materials Procurement Agency. He also personally assured the Joint Committee that GAO made "no contention of any wrongdoing" by Mr. Young.

The people of this nation can have little faith in any agency of Government which fails to exhaust every avenue of investigation before it charges a patriotic citizen with failure to properly carry out a public trust. The General Accounting Office is no exception. Being responsible to Congress this agency should lean over backwards to be sure that its reports are based solidly upon facts and fair and full investigation. Unfounded or erroneous reports impugning the actions of a loyal public servant cannot be too strongly condemned.

Howard Young, as has been suggested from some sources, may have been the "guinea pig" for those in Government who desire to remove business men from policy posts in Government, relegate them to a mere advisory role, and replace them with career employes who in many cases cannot possibly have the experience, industrial knowledge and sound judgment needed for efficient administration of the biggest business of all—the United States Government. But in this case, they had an adversary with the courage to face up to them, and to demonstrate to the American people that business men in Government positions can unselfishly work for the good of the country. For the simple truth has vindicated Howard Young before the Congress, the industry he serves so well, and the American public.

Great is the truth!

Fig. 1—Hoistman has full speed or crawl at his finger tips

Mine Hoists With Dual AC-Motors Operated Successfully

Two Motors Work in Parallel for High Speed Hoisting or Opposed for Slower Operation

By W. TRENT NEWLAND and A. H. MYLES

Electrical Engineer, The New Jersey Zinc Co.

Assistant Chief Engineer, The Electric Controller & Mfg. Co.

SEVERAL years ago The New Jersey Zinc Co. faced with the problem of replacing an old steam-powered drive on the men-and-materials hoist at their Austinville, Va. mine selected a design for a control system using two ac motors geared to the common main-drive shaft.

Despite the extremely wide variation of load—often from heavy hoisting to heavy overhauling during one operating cycle—this dual-motor design proved so economical in installation and so successful in operation that the company has since selected similar type controls for new mines at Ogdensburg, N. J., and Ivanhoe, Va., and now is making a fourth installation of this type at their zinc mine in Jefferson City, Tenn.

First installation consisted of two 75-hp motors, the second of two 200-hp. and the third and fourth of two 150-hp units. All are two-cage men-and-material hoists except the one at Ivanhoe which is a single-cage operation balanced with a cast iron counterweight.

Basic principle of the dual-motor design has long been known. While the hoists are accelerating and running normally in either direction the two motors operate in parallel, each supplying half the total horsepower and torque requirements. To provide proper slowdown under normal load or when the load becomes overhauling, the torque of one of the motors is reversed and the speed of the hoist is then proportional to the resultant torque which is the difference between the two torques.

Although this basic principle has proven successful on many applications, such as barge-shifting winches, etc., the accurate performance required of a mine hoist has only recently been made available. By the addition of frequency responsive relays, energized by a frequency generator coupled to one of the motors, success for mine applications was found, as demonstrated by these New Jersey Zinc Co. installations.

Easy to Control Speed

With this system, close control of speeds is easily possible and overspeeding is prevented. During hoisting and lowering, acceleration is cushioned—for passengers, the cages can be made to creep to a stop. In a similar way, with automatic control, steady slow speeds can be achieved for reeving, or shaft or cable inspection. Though the rated speed of the

Figure 2—Two 200 hp motors with electric brakes and control frequency generator drive the mine hoist

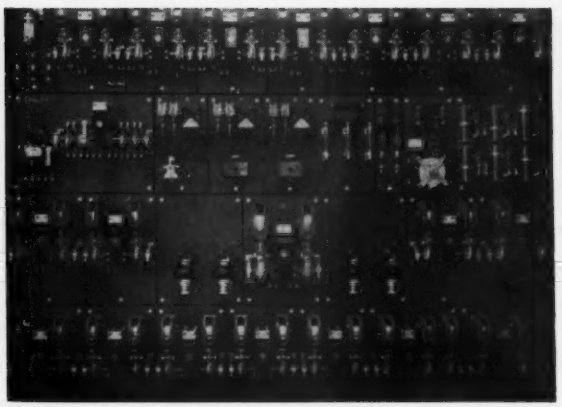


Figure 3—Control panel for mine hoist motors is central nervous system of hoisting equipment

hoists is 800 fpm for example, this can be reduced to 100 fpm for reeving or inspection.

The original cost of the installation is comparatively low. Although two small motors may be more expensive than a large one, the extra cost is offset to some extent by the saving in the smaller units required in the hoist drive.

Power supply for the frequency responsive relays is provided by an induction generator of less than one kw capacity, mechanically coupled to one of the motors through a 1:1 gear ratio and having a 3-phase primary and a single-phase secondary. The primary phase rotation is always the same as that of the No. 1 motor. Since the generator is wound with fewer poles per phase than the hoist motors and therefore has a higher synchronous speed, the generator rotor voltage and frequency, both of which vary inversely with speed, are not zero at the synchronous speed of the hoist motors. This provides for safety features by frequency relay operation.

Operation Safeguarded

Many safety devices are incorporated into the design. Combined centrifugal and cam switches geared to each hoisting drum provide protection against overspeed and overwind for both directions of travel. Track type limit switches provide for stopping at the final limit of cage travel. Brake-wear limit switches insure that the drum brakes have adequate stopping ability at all times. Hand brake lever and clutch position switches provide interlocking protection against releasing a drum brake when its associated drum is unclutched.

Relays are also provided to insure that an overload, a reverse phase condition, or undervoltage, cause power to be removed and all brakes to set. Backout switches protect the hoist against travel in the wrong direction after operation of the overtravel or overwind limit switches. For example, after either or both the North cage overwind or North cage final limit switches have tripped, the North backout switch must be moved to North backout position before an undervoltage relay or brake contactor can be reclosed. With this switch in the North backout position, the North up-directional contactor circuit is opened, allowing operation in the South up-direction only.

Operating speed-torque curves for each motor and maximum unbalanced and maximum normal balanced torque requirements are given in Figure 4. A hoist is considered to be balanced when both drums are clutched to the main shaft, and unbalanced when only one drum is clutched, even though an unbalanced condition can exist when both drums are clutched in. The torque requirements in Figure 4 are shown as vertical broken lines and are in percent of the full load torque of one motor with the North cage at the bottom of the shaft and loaded.

Curves 10 to 17, inclusive, are for the No. 1 motor when it is connected for full speed hoisting of the North cage, and curves 20 to 27 for the No. 2 motor when likewise connected for the South cage. The two sets of curves are, of course, superimposed with both motors sharing the load.

Opposing Motors Slow Cage

When the torque of one of the motors is reversed the resultant speed-torque curves are as illustrated in Figure 5, the fourth master point conditions being used as an example here. When the North cage is loaded and approaching the top, the actual load, for an exemplary installation, is ap-

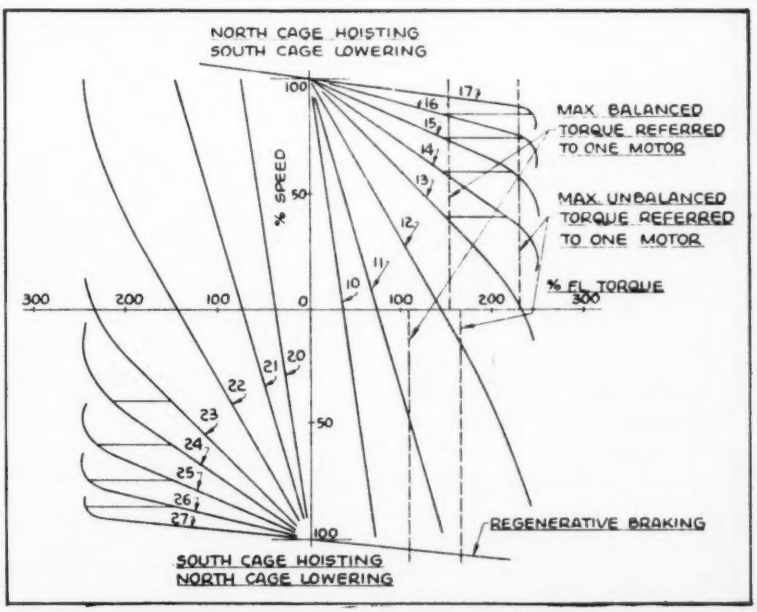


Fig. 4—Characteristic speed-torque curves fo each wound-rotor motor of two-motor mine hoist

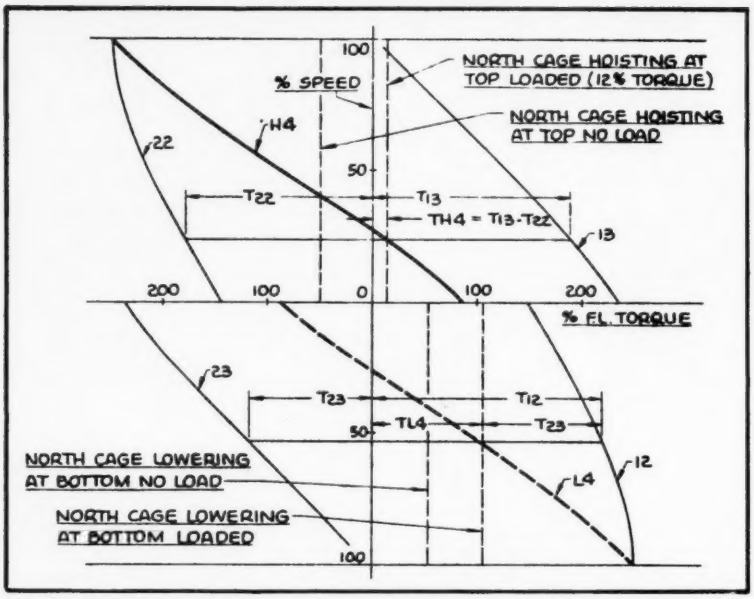


Fig. 5—Method of combining speed-torque curves (fourth master-point—hoist and lower)

proximately 12 percent of the full load torque of one motor. With the No. 1 motor having a rotor resistance giving speed-torque curve 13, and with the primary of No. 2 motor reversed and a rotor resistance giving speed-torque curve 22, the resultant speed-torque curve is H4. The torque values of curve H4 are the sums of the corresponding torque values of curves 13 and 22.

For example, at approximately 25 percent speed, the torque of the No. 1 motor is T13 and that of the No. 2 motor is T22. Subtracting T22 from T13 gives TH4 or 12 percent resultant torque in the hoisting direction. Similarly, the resultant curve L4 is derived from the individual motor speed-torque curves 23 and 12 and indicates the performance when the North cage is being lowered.

By proper selection of the individual motor speed-torque curves for each master control point, a family of desirable resultant speed-torque curves can be obtained as shown in Figure 6. This permits the speed under any condition of loading to be reduced in selective steps through a creeping speed to a stalled condition.

The slow stable speed required for shaft and cable inspection is obtained with the 2-motor drive by automatically controlling the rotor resistance and the primary connections of the motors. Figure 7 shows how the frequency responsive relay which has a close differential between pick-up and drop-out holds the speed at approximately 100 ft per minute throughout the entire travel distance of the hoists.

Relays Control Speed Zones

A separate four-speed master switch is used to control the primary connections of the motors. Each speed point provides motor connections which permit the relay to maintain control for a certain portion or zone of the travel distance. As the cages travel out of a control zone, the relay relinquishes control until the master is moved to the next point. A transfer switch is used to transfer from the main to the slow speed master switch.

When an empty cage is at the bottom, the torque required to hoist it is approximately 95 percent of the full load torque of one motor. If the slow speed master switch is placed in the fourth point hoist, each motor is connected for approximately 75 percent stalled torque in the same direction and the load accelerates along curve 5 (Figure 7). When the speed reaches 100 fpm the speed control relay operates a second relay to reduce the torque of both motors to a stalled value of approximately 35 per-

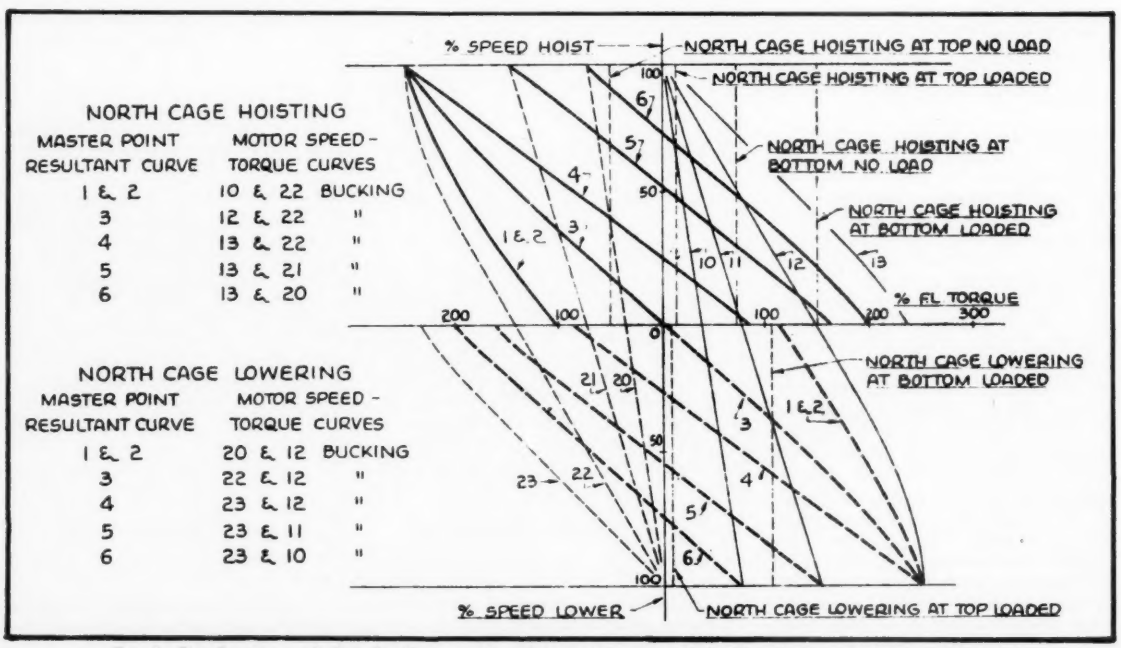

NORTH CAGE HOISTING
MASTER POINT RESULTANT CURVE
MOTOR SPEED - TORQUE CURVES
1 & 2 10 & 22 BUCKING
3 12 & 22 "
4 13 & 22 "
5 13 & 21 "
6 13 & 20 "
NORTH CAGE LOWERING
MASTER POINT RESULTANT CURVE
MOTOR SPEED - TORQUE CURVES
1 & 2 20 & 12 BUCKING
3 22 & 12 "
4 23 & 12 "
5 23 & 11 "
6 23 & 10 "
% SPEED HOIST
NORTH CAGE HOISTING AT TOP NO LOAD
NORTH CAGE HOISTING AT TOP LOADED
NORTH CAGE HOISTING AT BOTTOM NO LOAD
NORTH CAGE HOISTING AT BOTTOM LOADED
% FL TORQUE
300
NORTH CAGE LOWERING AT BOTTOM LOADED
% SPEED LOWER
NORTH CAGE LOWERING AT TOP LOADED

Fig. 6—Deceleration and slow loading speed performance curves obtained with control of two-motor hoist

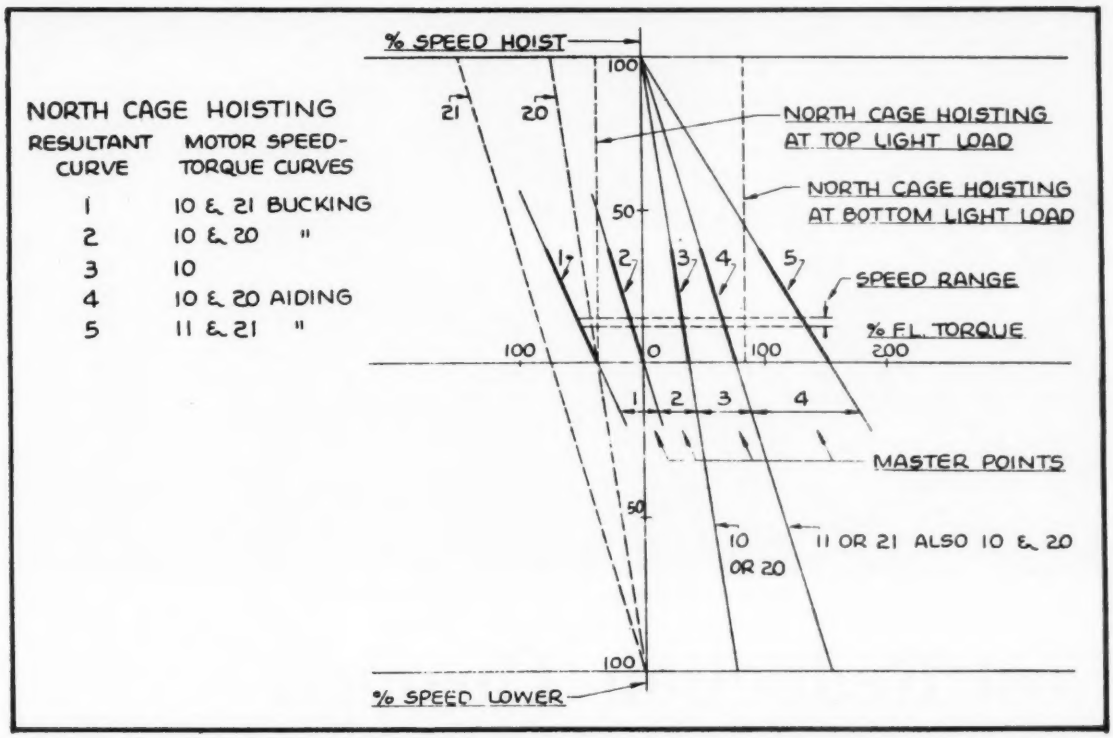


Fig. 7—Shaft inspection and cable reeving speed control with speed control frequency relay and separate four point master switch—south cage hoisting operation is identical

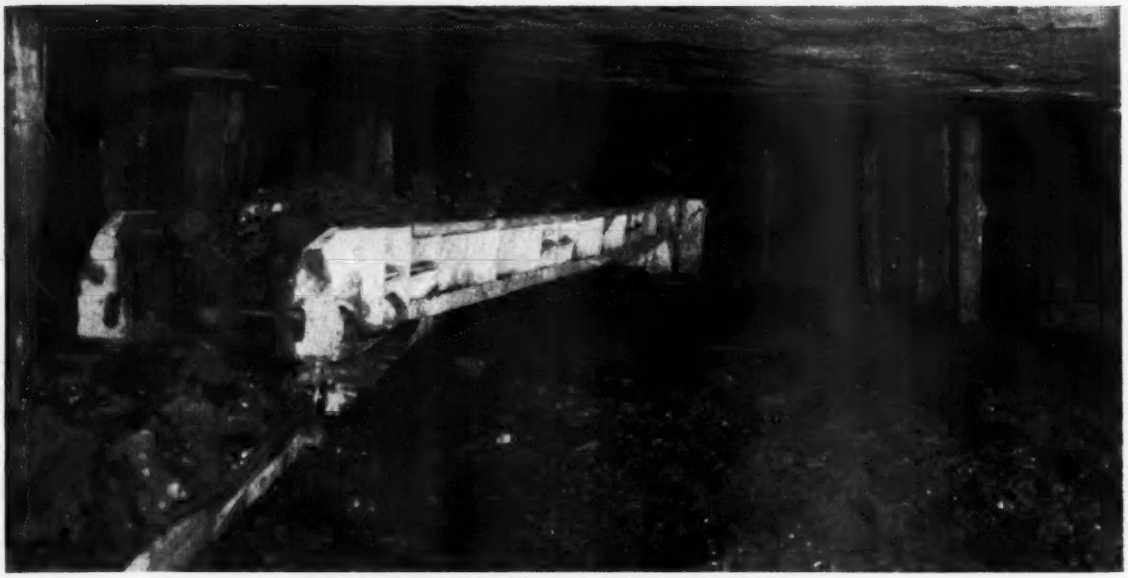
cent. The motors now operate along curve 4. The speed immediately decreases. The relay then closes, thereby increasing the motor torque (curve 5). The two relays thus operate repeatedly to hold the speed near 100 ft per min.

As the cage is lifted, the torque required becomes less and eventually the speed control relays lose control. The slow speed master is then moved to the third point which results in the No. 2 motor being disconnected, and the speed control relays again take over to control the torque of only the No. 1 motor by changing its secondary resistance.

As the cage continues up and the load becomes still less, the master is then moved to the second point. The relays now connect the No. 2 motor for weak down torque, when required, to hold the slow speed constant. As the cage approaches the upper limit the hoist becomes overhauling in the up direction, and the master is moved to the first point. Here the relays control the value of down torque on the No. 2 motor to maintain the same speed. When the upper limit is reached, the master is turned to the off position to remove power and set the brakes. Under all slow speed operation the torque requirements of the motors are 70 percent of rated torque or less, thus preventing overheating.

Another use of the slow speed control is to facilitate reeving or unreeving of cable. During this operation, the motor loading is friction only. The steady slow speed obtained on the second position of the master is ideal for this operation.

Dual ac-motor mine hoist was installed at Austinville, Va.



The key to reduced mining costs is increased productivity

Cost Reduction Through Industrial Engineering

Can't be Done Overnight, but a Well-thought-out Program Can Pay Off in a Big Way

By VICTOR L. HURLEY
Mine Superintendent
Warner Collieries Co.

THE ability of a company to cut its cost is much more important today now that a vigorous competitive market is back. Many companies face the danger of being eliminated as marginal producers unless they can make drastic reductions in their costs. They might revert to desperation measures such as cutoffs, but this is not the answer to the problem.

Proper use of industrial engineering principles alone can reduce the cost of production in any mining company from 10 to 40 percent. Industrial engineering is not just a matter of making time studies as many people believe. Actually, industrial engineering includes the establishment of cost, delay, and supply control and should play a major role in planning the future production and marketing of coal by a company. A well established industrial engineering department should be the nerve center of a company because only through the application of industrial engineering can methods, costs, and delays be properly analyzed and controlled.

Ultimate Aim—Cost Control

Probably all coal companies maintain a fairly accurate record of their costs, but there is a vast difference between a record of costs and controlling costs. A record of costs is much like a post-mortem. By the time they are compiled it is too late to reduce them. Controlling costs is a process of reducing and predicting costs. It enables top management to put its finger on trouble areas immediately.

In setting up a cost control program, it is first necessary to break down the total cost of production into its various components such as overhead, supplies, labor, etc., then analyze each one individually. Many items of cost are fairly uniform and easily predicted. Some of these are various rentals, taxes, labor benefits, and certain items of overhead. The most difficult items to predict are labor cost and production, and these are the most important items in the cost structure of coal production.

The usual action taken to lower labor costs is to make sudden slashes or equipment changes. These actions are working on the effect. They seldom get at the cause. In short, it is the technique of perpetually pumping water out of the bilge without repairing the hull. These desperation methods of cost reduction are evidence of lack of control.

Need Increased Productivity

The key to reducing labor costs is more productivity per man. Basically, there are two ways to do this: (1) put better equipment into service, or, (2) install better methods, and encourage men to develop more skill and put out more effort. The first way has changed the mining industry tremendously in the past 15 years, but it is costly and quite often difficult for a relatively small operator. The

second method is cheaper than the first, more lasting, and brings about the first step to cost control.

Changing the working habits of men is sometimes quite difficult because they immediately are suspicious of the motive for the changes. Many men fear that an increase of productivity per man will result in reduced working time or a layoff. These changes must be made gradually and may take as long as one or two years to complete. Many of the fears can be dispelled by explaining to the men the net result of the changes in regards to themselves. A successful cost reduction program can result in more working time, actually, and more men being employed because the markets will expand for the companies who are able to reduce their costs sufficiently.

A classic example of this principle is the Ford Motor Co. In 1909, less than 11,000 Model T's were sold for an average price of $950. Henry Ford then began changing methods and established mass production with an assembly line. In 1914, just five years later, he doubled his employes' wages, yet sold 248,000 Model T's for $490, about half of the 1909 price.

Coal mines can be put on an assembly line basis also, with the same result achieved by Henry Ford. Of course, changes in natural conditions make the job of setting up so-called "assembly line" methods difficult, but by no means impossible. Natural conditions cannot be changed, but their effects on production, except in extremely unnatural conditions, can be measured and predicted and methods of work can be changed to fit the various combinations and conditions. Measurement and prediction is the basis for increasing productivity per man.

Educate Management

The first step in organizing a cost reduction program through industrial engineering is to educate all levels of management to the purpose, scope, and principles of the program. The industrial engineer's primary tool is time study, and members of management should thoroughly understand time study methods and results. Only in this manner will they trust and be able to apply the work standards which grow out of time study. Just one diffident member of top management can retard the program or even sabotage it out of existence. Mine management must understand the program to enable them to properly answer the questions of their men. The selling of the cost reduction program to both men and management is vitally important to obtain the maximum benefit from it.

Time Study for Vital Information

The next step is to train time-study observers to collect the necessary data. These men should be chosen carefully from within the company. A higher education is not needed, but the observers should be familiar with mining and should have a good personality, because human relations play a major role in their work. Many mine foremen or section foremen make excellent observers.

Every phase of work concerned with mining is time studied. Each phase is broken down into as many simple, short elements of time as possible. For instance, "pick up shovel" will become an element even though it may only take 0.05 of a minute to perform. These elements of work are then timed in the various conditions which prevail at the mines until normal times can be assigned to them in each condition.

This method of time study is called the Standard Data method, and is much more flexible than the Direct Time-study method, in which individual time studies are analyzed separately. By using the Standard Data method, the industrial engineer is able to establish methods of performing a job which are more effective than the methods being used merely by rearranging the sequence of element times to make better use of a helper or of a man's location.

All element times of work fall into one of two groups, constants, or variables. A constant element time is one which is either not affected by conditions, or effected in a predictable manner. The element time of "pick up shovel" is considered a constant because one man in a crew should perform it in the same time as another member of the crew, or even a man in a different mine. The only condition that could effect this element is height, and the difference caused by a change in height can easily be measured. A variable element time is one which cannot be predicted such as breaking thick slate with a hammer. Actually, very few variables occur in coal mining, and these can be fairly accurately averaged.

Balance Crew Work Load

After element times have been established for all phases of coal production, working standards can be set up. The standards are made by adding together all of the element times which are necessary to perform a cycle, such as cutting or loading. The order of the elements are arranged in such a manner as to minimize delay time within the cycle. Then the various cycles are balanced as closely as possible by taking certain work, such as rockdusting, from one cycle and adding it to another. The balancing of the cycles is very important for obvious reasons. A loading crew should not load 10 cuts if only five have been prepared. If the loading is twice as fast as the preparation, it only means that the loading crew will waste half of its time.

Working standards must be made up to fit all the combinations of equipment and conditions in the mine. These standards can normally be summarized in just a few charts which cover a wide range of condition changes.

Once the working standards are established, the methods of reducing labor costs become easily apparent. The standards show the exact number of men which are needed, and what production can be expected from them. Over a period of time, possibly as long as two or three years, the working force should be rearranged until

Using the same mining equipment, crew performance improved from 17.8 to over 50 tons per man at the face in two years

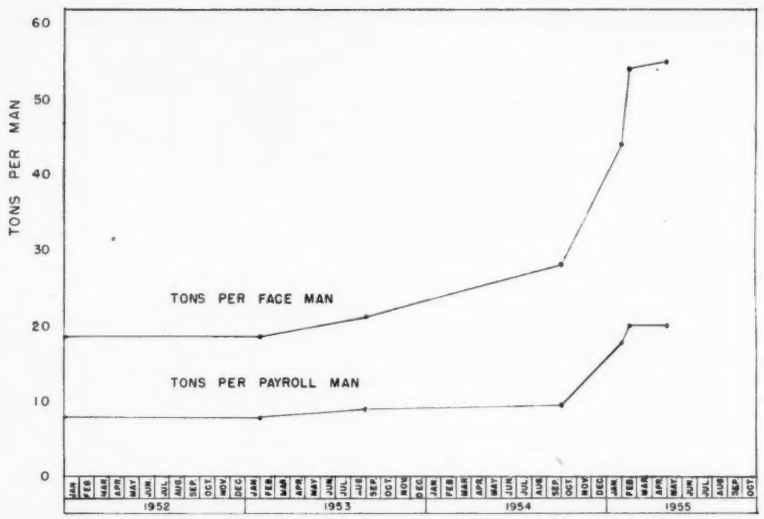
standard size crews are established. Then their methods of work should be altered until they conform reasonably close with the standard methods. This phase of the program consisting of rearranging the crews and altering their methods will appreciably lower the labor cost.

Wage Incentives

The Society for Advancement of Management has established the fact that the average worker can be expected to produce only 75 percent of a normal day's work with no form of incentive, while with an incentive, the same worker will average approximately 115 percent of a normal day's work. This is an increase in productivity of 53 percent. In other words, an incentive can reduce fixed overhead costs, such as salaries, by 53 percent Therefore, the next logical step to take in the cost reduction program is to install wage incentives. At least this was the case at Warner Collieries.

The installation of incentives not only reduces costs, it also makes the prediction of future costs and production much more accurate. A fair wage incentive will give the workers the opportunity to increase their wages by at least 25 percent. It will pay workers the same percent increase in wages as the percent increase in their effort over the standard pace. The incentive earnings paid to the men does not increase the labor cost, but makes it become virtually a constant. For example, if at 75 percent of standard the labor cost is $1.33 per ton, at a standard pace the cost becomes $1.00 per ton. Beyond this point, say at 115 percent of standard, the cost becomes $0.85 per ton, but the $0.15 saving is paid back to the men. This is the 15 percent increase in wages for 15 percent more work. In other words, the labor cost becomes fixed at $1.00 per ton. This fixed cost is $0.33 less than the cost would have been with no incentive.

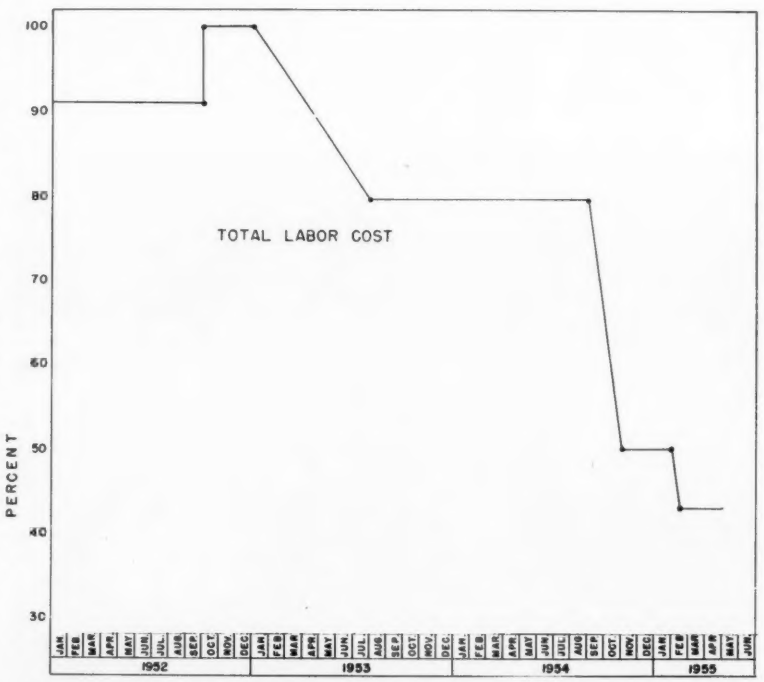
The calculations for wage incentive are based on time rather than production. In this manner, the incentive is paid on additional effort and skill which is the only fair measure of a man's performance. Conditions, type of equipment, and mining plan do not effect the worker's opportunity to make additional earnings because these factors alter the standards. In other words, a crew working in three ft of coal with a bad top condition can make just as much incentive pay as a crew working in six ft of coal with excellent conditions. Delays which cannot be prevented by the men such as equipment breakdowns and power failures do not subtract from the premium pay earned. During these delays, the men are taken "off standard" and receive only their base pay for the duration of the delay. Of course, the base wages of the men are guaranteed.



Production per man has followed this general growth. Note that wage incentives which went into effect in February were responsible for only the last few tons

Need Preventive Maintenance

Incentive is the key to accurate predictions because the labor cost for a given set of conditions and equipment remains almost constant. "Blue Mondays" are eliminated. Production also becomes more constant. The only things which will appreciably affect the labor cost and production are equipment changes, mining plan changes, conditions changes, and breakdowns. The change in cost and production due to equipment and mining plan changes can be very accurately calculated beforehand by using the standard data which has been established by time studies. Charges in cost and production due to condition changes can likewise be calculated beforehand with proper prospecting and diamond drill core information. Of course, there are normally local condition changes which are not established by prospecting and drilling, but it is reasonable to believe they would not alter the prediction of costs and production by more than 10 per-



Labor costs have followed this pattern. The rise in September 1952 reflects a wage increase

cent. In most seams, the percent of error should be much less. Changes in cost and production due to breakdowns are the most difficult to predict. An overhauling, preventive maintenance, and scheduled lubrication program should be installed in the very beginning of the cost reduction program. Mechanical failures cannot be eliminated entirely, but they can be minimized to the point where they won't vary the cost by more than 5 percent. Once the percent of delay time has been calculated for several months, the error in cost prediction can probably be cut to 2 percent or less.

After standard data and standard costs have been developed for the entire mining operations, long range predictions of total costs and production can be made. These predictions should not vary with the actual performance by more than 10 percent.

Reports and Controls

The final phase of the cost reduction program is setting up a system of reports and controls which will enable management to maintain low costs and which will point out ways to reduce them even further. The controls should furnish a daily comparison of standard and actual costs, broken down into the various subdivisions which make up the total cost. Waste dollars should be listed and broken down to show what caused the various fluctuations of costs. These controls should state in terms of dollars, what each delay costs. Controls lift a large portion of the burden off top management because they not only point out the trouble areas in a cost structure but also show to what length management can go to correct them. They eliminate much of the guesswork and hunches often found in managerial decisions. The control reports are the foundation of scientific management.

One Company's Results

The Warner Collieries Co. started its cost reduction program through the use of industrial engineering principles three years ago. It took two years to adapt industrial engineering principles to the coal industry and work out many of the problems which are unique to coal mining. During this period, only a few benefits were derived from time-study data. However, in January of 1953, a rebuilding, preventive maintenance, and scheduled lubrication program was started and costs gradually came down as delay time was brought under control. The average delay time due to equipment failure was sliced from 25 percent of the shift to less than 5 percent of the shift.

During the summer of 1954, the time-study data collected two years earlier was put into use in the form of standard planning for a new mine. All of the crews and day men were laid out in advance along with a prediction of costs and production, which later proved to be quite accurate. When the mine was opened, only the number of men called for in the standards were put to work. Costs started falling immediately. In August, all of the foremen at the mine were brought through the Standards Department for a training program. Time studies were started in November, and in three months the necesary data was accumulated to set up work standards for the entire mine. On February 1, this year, the wage incentive program was installed. By February 15, the tons per man on the payroll had risen to 19.7, an increase of over 10 tons per man in less than six months. In this same period, the labor cost dropped over $1.00 per ton. This made a total labor cost reduction of 57 percent in three years.

It may be a natural assumption for many mining men to make, that the costs were reduced because the mine is new, so let's examine the change in face performance. In the past two years, the performance has improved from 17.8 tons per man at the face to over 50 tons per man at the face. These figures are based on a 12-man crew using the same equipment. This increase in productivity was made not only with the same equipment, but also with the same men and supervisors. The management of Warner Collieries attributes this phenomenal decrease in cost almost solely to Industrial Engineering and the change of thinking that this program has brought about.

Balancing the work load among crew members has paid good dividends

"They're digging the coal back there, Finley!!"

Mining Goes to Las Vegas

Desert Resort Ready for 1955 Metal Mining and Industrial Minerals Convention of American Mining Congress

ANOTHER year has rolled around and another big American Mining Congress Metal Mining and Industrial Minerals Convention is coming up. This special section of the JOURNAL contains a preview of what mining men, and ladies, can expect when they come to Las Vegas for the annual western get-together, October 10 through 13.

Each fall, mining men come to the AMC Convention from every section of the country and from abroad to take stock of the industry. They review the current situation. The economic and legislative status of the industry is carefully examined and the course the industry will follow in its relations with Government is defined in the Declaration of Policy drawn up and adopted at the meeting.

The comprehensive 19-session program which was formulated at a meeting called by National Program Committee Chairman L. J. Randall, president, Hecla Mining Co., last June, has now become a reality. Cabinet officers, United States Senators and Representatives, and other high Federal and State officials have accepted the Committee's invitation to take part in the proceedings. They will be on hand to talk things over at first hand with industry spokesmen in the meeting rooms. They will also rub shoulders with mining men at the social functions and at "corridor confabs" during the Convention—with a resultant gain in mutual understanding of many matters that are of vital interest to the Nation and to the industry.

In the operating sessions topnotch mining engineers, geologists and metallurgists will bring out the details of problems faced at operating properties and tell how they were solved. As always, where time permits, the sessions will be thrown open for questions and comments from the floor. This type of discussion can often bring out special points of the topic under discussion that might never be aired in any other way.

On Tuesday and Wednesday a series of four sessions dealing with the many problems of the uranium industry has been scheduled. Specialists in exploration and development of uranium deposits and the mining and treatment of uranium ores will cover the latest methods and equipment, as well as formerly classified information revealed at the recent Geneva Conference. The final session Wednesday will deal with AEC policies and the outlook for future production and consumption of radioactive materials.

Pages 54 to 57 contain an up-to-the-minute outline of what subjects will be covered at the

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California

H. A. ZIEBELL
Washington

meeting—and by whom. While there may be minor changes in the starting lineup, these pages present a real preview of the character and quality of the subject matter at this year's meeting. Careful study of the program will help to make the time spent in the meeting rooms pay real dividends.

Each year more and more mining companies are finding that it pays to send as many key men as possible to the Mining Congress Convention, and that advance planning in this respect pays off just as it does in laying out a new stope or level.

The Program Committee for the 1955 Metal Mining and Industrial Minerals Convention merits the thanks of every mining man in the country for the fine program to be presented and for the cooperation of its members in securing outstanding speakers.

Frame Resolutions

One of the most important products of the American Mining Congress Convention will be the Declaration of Policy—which will spell out in unequivocal language just where the industry stands on matters of national import. The "Declaration" serves as a guide for the organization during the next twelve months in matters of national policy.

The Resolutions Committee is headed by Kenneth C. Kellar of Lead, S. Dak., and includes leaders in all branches of the mining industry from all sections of the country. Its report will be presented in sections at the various sessions of the Convention, affording an opportunity for careful consideration, and making it possible to give full publicity to the industry's position on public questions.

WESTERN DIVISION

THE AMERICAN MINING CONGRESS

ROY A. HARDY, Chairman
Consulting Engineer in Charge
Getchell Mine Inc.

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W. L. ZEIGLER, Gen. Mgr., Pend Oreille Mines & Metals Co.

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Ladies Hospitality

MRS. HEWITT S. WEST
Co-Chairman

Photo Not Available

MRS. JOSEPH WELLS
Co-Chairman

Entertainment Plans

Las Vegas is probably the most famous fun spot in the world. Each hotel on its famous "Strip" presents two big shows nightly. They offer famous stars on the stages of their dining rooms and excellent food on the tables. It has been decided therefore to schedule only one official evening entertainment feature at this year's meeting. This will take place on Monday, October 10—a big Barbecue and Western Party in the Last Frontier Village. Here, amid relics of the Old West, mining men and their ladies will eat good old-fashioned barbecue cooked over coals in pits dug in the ground. This good food plus some real Western music and songs with dancing in the street will continue until time for the second show at the hotels. Fun and good fellowship plus "refreshments a la carte" are bound to make this an evening long remembered.

Hewitt S. West's many friends in the industry were shocked and saddened to learn of his unexpected death on Septembr 2. Both he and Mrs. West have taken an active part in the preparations for this meeting. A large part of the credit for the arrangements belongs to him.

The fabulous stage productions of Las Vegas were mentioned above. Top stars of stage, screen, radio and TV appear nightly in lavish

(*Continued on page* 58)

DOUGLAS McKAY
Secretary of the Interior

ARTHUR S. FLEMMING
Director, Office of Defense Mobilization

CHARLES H. RUSSELL
Governor of Nevada

REX BELL
Lieutenant Governor of Nevada

BARRY GOLDWATER
Senator from Arizona

HARRIS ELLSWORTH
Congressman from Oregon

CLIFF YOUNG
Congressman from Nevada

Convention Program

MONDAY, OCTOBER 10

8:30 A.M. REGISTRATION, Silver Slipper

9:40 A.M.—PRE-SESSION MOTION PICTURE—
"Nevada and Its Natural Resources"

10:00 A.M. National Policies and the Mining Industry

Chairman: HOWARD I. YOUNG, *Pres.*, American Zinc, Lead & Smelting Co.; President, American Mining Congress

The Department of the Interior and the Mining Industry
HON. DOUGLAS MCKAY, *Secretary of the Interior*

Mobilization Progress and the Mining Industry
HON. ARTHUR S. FLEMMING, *Director*, Office of Defense Mobilization

Reports of Resolutions Committee:
General Policy
Government Reorganization

12:15 P.M. Welcoming Luncheon—

Presiding: ROY A. HARDY, *Consulting Engr. in Charge*, Getchell Mine, Inc.; Chairman, Western Division, American Mining Congress

Welcome to Nevada
HON. CHARLES H. RUSSELL, *Governor of Nevada*
HON. REX BELL, *Lieutenant Governor of Nevada*

Responses
HOWARD I. YOUNG, *Pres.*, American Zinc, Lead & Smelting Co.; President, American Mining Congress
L. J. RANDALL, *Pres.*, Hecla Mining Co.; National Chairman, Program Committee
J. W. OVERSTREET, *Pres.*, National Electric Coil Co.; Chairman, Manufacturers Division, American Mining Congress
L. C. CAMPBELL, *Vice Pres.*, Coal Div., Eastern Gas & Fuel Associates; Chairman, Coal Division, American Mining Congress

Introduction of Distinguished Guests

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1:40 P.M. PRE-SESSION MOTION PICTURE—
"And From This Earth"

2:00 P.M. Labor and Management Problems; Public Relations

Chairman: DENISON KITCHEL, *Attorney*, Phoenix, Ariz.; Chairman, A.M.C. Labor Relations Committee

Public Relations in the Mining Communities
HON. BARRY GOLDWATER, *U. S. Senator from Arizona*

Developments Under the Taft-Hartley Act
HON. PHILIP RAY RODGERS, *Acting Chairman*, National Labor Relations Board

Trends in Labor Relations
RUFUS G. POOLE, *Attorney*, Washington, D. C.

Trends in Employe Housing and Townsite Development and Financing
GERALD H. GALBREATH, JR., *Vice Pres.*, John W. Galbreath & Co.

Reports of Resolutions Committee:
Labor Relations—Mine Safety—Social Security

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1:40 P.M. PRE-SESSION MOTION PICTURE—
"America's Iron Frontier"

2:00 P.M. Milling and Metallurgy

Chairman: F. D. DEVANEY, *Chief Metallurgist*, Pickands Mather & Co.

Aerofall Mill at Star Lake
R. E. DUROCHER, *Asst. Mgr.*, New York Ore Div., Jones & Laughlin Steel Corp.

Cylone Classification and Concentration—A Panel Discussion
LYLE M. BARKER, *Mgr.*, Morenci Branch, Phelps Dodge Corp.
S. J. MCCARROLL, *Gen. Supt.*, Manganese, Inc.
L. J. ERCK, *Chief Metallurgist*, Cleveland-Cliffs Iron Co.
EARL C. HERKENHOFF, *Metallurgist*, Pickands Mather & Co.

Modernization of Pandora Mill at Telluride
FRANK W. MCQUISTON, JR., *Chief Metallurgist*, Newmont Mining Corp.

PHILIP RAY RODGERS
Acting Chairman, NLRB

FRANK W. BARRETT
Senator from Wyoming

CLINTON P. ANDERSON
Senator from New Mexico

ARTHUR V. WATKINS
Senator from Utah

CLAIR ENGLE
Congressman from California

HENRY C. DWORSHAK
Senator from Idaho

GEORGE W. MALONE
Senator from Nevada

WILLIAM A. DAWSON
Congressman from Utah

JOHN RHODES
Congressman from Arizona

THOMAS E. MARTIN
Senator from Iowa

T. COLEMAN ANDREWS
Commissioner of Internal Revenue

FELIX E. WORMSER
Assistant Secretary of the Interior

S. L. R. McNICHOLS
Lieutenant Governor of Colorado

ALAN BIBLE
Senator from Nevada

1:40 P.M. PRE-SESSION MOTION PICTURE—
"Corralling the Colorado"

2:00 P.M. Exploration and Geology

Chairman: J. D. FORRESTER, *Dean*, School of Mines, University of Idaho

Geophysical Exploration in New Brunswick
HAROLD O. SEIGEL, *Consultant*

Geochemical Prospecting—Applications and Limitations
HUBERT LAKIN, *Acting Chief*, Geochemical Exploration Section, USGS

Observations on Geobotanical Prospecting
T. O. EVANS, *Chief Mining Engineer*, Atchison, Topeka & Santa Fe Railway Co.

"Operations Research" Applied to Nickel Reserves at Riddle, Oreg.
WALTER R. VAN VOORHIS, *Chairman*, Dept. of Mathematics, Fenn College; L. E. ANDREWS, JR., M. A. Hanna Co., and GEORGE D. CREELMAN, Creelman Associates

Ground Water Problems in Desert Areas
HUGH A. SHAMBERGER, *Nevada State Engineer*

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5:30 P.M. Barbecue and Western Party

TUESDAY, OCTOBER 11

9:25 A.M. PRE-SESSION MOTION PICTURE—
"Gray Gold from the Mother Lode"

9:45 A.M. Public Lands Panel

Chairman: HON. FRANK A. BARRETT, *U. S. Senator from Wyoming*
HON. CLINTON P. ANDERSON, *U. S. Senator from New Mexico*
HON. ARTHUR V. WATKINS, *U. S. Senator from Utah*
HON. CLAIR ENGLE, *U. S. Representative from California;* Chairman, House Interior & Insular Affairs Committee
HON. HARRIS ELLSWORTH, *U. S. Representative from Oregon*
HON. CLIFF YOUNG, *U. S. Representative from Nevada*
HON. RICHARD E. MCARDLE, *Chief*, U. S. Forest Service;
Representative, Department of the Interior
W. HOWARD GRAY, *Attorney*, Ely, Nev.
RAYMOND B. HOLBROOK, *Counsel*, Western Operations, U. S. Smelting Refining & Mining Co.; Chairman, A.M.C. Public Lands Committee
WILLIAM G. WALDECK, *Attorney*, Montrose, Colo.

Reports of Resolutions Committee:
Public Land Policy
Water and Air Pollution

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9:25 A.M. PRE-SESSION MOTION PICTURE—
"Mining for Nickel"

9:45 A.M. Drilling—Roof Support

Chairman: S. S. GOODWIN, *Vice-Pres.*, New Jersey Zinc Co.

Airlegs vs. Jumbos
S. S. CLARKE, *Consultant*
Discussion: J. L. RAMSELL, *Mgr.*, Kerr-Addison Gold Mines, Ltd.

New Developments in Rotary Drilling
H. A. CORRE, *Mine Supt.*, Warner Co.
RICHARD MOE, *Mine Supt.*, White Pine Copper Co.

Yieldable Steel Arches for Roof Support
R. W. SLEEMAN, *Chief Mining Engr.*, Bethlehem Cornwall Corp.

Discussion: R. C. NISPEL, *Underground Mine Supt.*, Nevada Mines Div., Kennecott Copper Corp.

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9:25 A.M. PRE-SESSION MOTION PICTURE—
"A Is for Atom"

9:45 A.M. Uranium Milling

Chairman: T. O. EVANS, *Chief Mining Engr.*, Atchison, Topeka & Santa Fe Railway Co.

History and Trends of Uranium Plant Flow Sheets
A. Q. LUNDQUIST, *Gen. Supt.* and J. L. LAKE, *Chief Metallurgist*, Union Carbide Nuclear Co.
Discussion: E. H. CRABTREE, *Dir.*, Colorado School of Mines Research Foundation, Inc.

Operational Difficulties in Starting a New Uranium Mill
CLYDE E. OSBORN, *Mgr.*, Uranium Div., Kerr-McGee Oil Industries, Inc.

Lime Penalty on Uranium Ores
PAUL HENSHAW, *Utah Div.*, Homestake Mining Co.

12:15 P.M. Strategic Minerals Luncheon

Chairman: S. H. WILLISTON, *Vice-Pres.*, Cordero Mining Co.; Chairman, A.M.C. Strategic Minerals Committee.

Address: HON. CLAIR ENGLE, *U. S. Representative from California*

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1:40 P.M. PRE-SESSION MOTION PICTURE—
"Die Casting"

2:00 P.M. Outlook for the Mineral Industries

Chairman: L. J. RANDALL, *Pres.*, Hecla Mining Co.

Nonferrous Metals—CHARLES R. INCE, *Vice-Pres.*, St. Joseph Lead Co.

Iron Ore—A. L. FAIRLEY, JR., *Vice-Pres.*, Snyder Mining Co.

Light Metals—WALTER L. RICE, *Pres.*, Reynolds Mining Corp.

Industrial Minerals—J. L. GILLSON, Development Dept., E. I. du Pont de Nemours & Co., Inc.

Reports of Resolutions Committee:
Mine Financing—Energy Resources

DESCRIPTIONS OF PLANTS TO BE VISITED OCT. 13

Rare Earths Operation of Molybdenum Corp. of America—
E. A. LUCAS, *Vice-Pres., and* HAROLD D. BAILEY, *Mgr.*, Mountain Pass Mine, Molybdenum Corp. of America

Operations at Three Kids Manganese Mine and Treatment Plant—F. A. MCGONIGLE, *Vice-Pres. & Gen. Mgr.*, Manganese, Inc.

Operations at Western Electrochemical Co.—
ROBERT F. SHURTZ, Research Dept., Western Electrochemical Co.

Operations at U. S. Lime Products Corp.—
L. N. GRINDELL, *Mgr.*, Nevada Operations, U. S. Lime Products Corp.

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1:40 P.M. PRE-SESSION MOTION PICTURE—
"Iron Ore from Cerro Bolivar"

2:00 P.M. Improved Mining Methods and Equipment

Chairman: A. C. BIGLEY, *Gen. Mgr.*, Western Mining Operations, The Anaconda Co.

New Equipment for Underground Mining
ROGER V. PIERCE, *Consulting Engr.*
EARL H. MILLER, *Assistant Resident Mgr.*, United States Potash Co.

Trackless Mining of Trona
C. A. ROMANO, *Resident Mgr.*, and ROBERT F. LOVE, *Mine Supt.*, Intermountain Chemical Corp.

Changes at Mountain Con Mine
VINCENT D. O'LEARY, *Mine Supt.*, Mountain Con Mine, The Anaconda Co.

Water Handling and Control at Deep Ruth
JOHN C. KINNEAR, JR., *Gen. Mgr.*, Nevada Mines Div., Kennecott Copper Corp.

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1:40 P.M. PRE-SESSION MOTION PICTURE—
"The Search"

2:00 P.M. Uranium Exploration and Development

Chairman: PHILLIP L. MERRITT, *Senior Geol.*, E. J. Longyear Co.

Latest Uranium Prospecting Methods—A Panel Discussion
RALPH H. WILPOLT, *Mgr.*, Southern Div., Cullen Minerals Corp.
R. D. LYNN, *Geol.*, The Anaconda Co.
RUDOLPH A. BLACK, *Project Chief*, Ground Survey Section, U. S. Geological Survey
R. MAURICE TRIPP, Tripp Research Corp.

Summary of Domestic Uranium Activities
SHELDON P. WIMPFEN, *Mgr.*, Grand Junction Operations Office, Div. of Raw Materials, A.E.C.

Summary of World Uranium Developments
DONALD L. EVERHART, *Geologic Advisor*, Div. of Raw Materials, A.E.C.

WEDNESDAY, OCTOBER 12

9:25 A.M. PRE-SESSION MOTION PICTURE—
"Texas and Its Natural Resources"

9:45 A.M. Tariffs; Taxation

Chairman, Tariff Panel: HON. HENRY C. DWORSHAK, *U. S. Senator from Idaho*
HON. GEORGE W. MALONE, *U. S. Senator from Nevada*
HON. WILLIAM A. DAWSON, *U. S. Representative from Utah*

HON. JOHN RHODES, *U. S. Representative from Arizona*
ANDREW FLETCHER, *Pres.*, St. Joseph Lead Co.
W. LUNSFORD LONG, *Pres.*, Tungsten Mining Corp.
V. C. WANSBROUGH, *Exec. Dir.*, Canadian Metal Mining Assn.

* * *

Chairman, Taxation: HON. THOMAS E. MARTIN, *U. S. Senator from Iowa*

Fiscal and Tax Policies of the Federal Government
HON. T. COLEMAN ANDREWS, *Commissioner*, Internal Revenue Service
HENRY B. FERNALD, Loomis, Suffern & Fernald, New York; Chairman, A.M.C. Tax Committee
ELLSWORTH C. ALVORD, Alvord & Alvord, Tax Counsel, A.M.C.

Report of Resolutions Committee:
Taxation and Government Expenditures

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9:25 A.M. PRE-SESSION MOTION PICTURE—
"Arizona and Its Natural Resources"

9:45 A.M. Open-Pit Mining

Chairman: W. C. LAWSON, *Gen. Mgr.*, Phelps Dodge Corp.

Factors in Selection of Drillhole Size at Chino
G. J. BALLMER, *Supt. of Mines*, and K. V. N. HARRIS, *Gen. Mine Foreman*, Chino Mines Div., Kennecott Copper Corp.

Discussion: Dry Rotary Drilling and Akremite Explosive, HUGH B. LEE, *Pres.*, Maumee Collieries Co.

Company vs. Contract Truck Haulage
JOSEPH W. WELLS, *Pres.*, Wells Cargo Inc.
EVERETT L. JOPPA, *Gen. Mgr. of Mines*, Pickands Mather & Co.

Planning a Radio System for Profits
JOSEPH G. IVY, *Section Head*, General Engineering, International Minerals & Chemical Corp.

Discussion: Radio Communications in the New Cornelia Pit
J. A. LENTZ, JR., *Mine Supt.*, New Cornelia Br., Phelps Dodge Corp.

Mining and Milling the Jackpile Orebody
J. B. KNAEBEL, *Mgr.*, New Mexico Operations, The Anaconda Co.

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9:25 A.M. PRE-SESSION MOTION PICTURE—
"The Atom Goes to Sea"

9:45 A.M. Uranium Mining

Chairman: JOHN J. CURZON, *Director of Exploration & Development*, Climax Molybdenum Co.

Mechanized Mining on the Plateau
HAROLD B. SPENCER, *Pres.*, Centennial Development Co.
Discussion: VIRGIL A. BILYEU, *Supt.*, Utex Exploration Co.

Responsibility of State Safety Officials in Uranium Mine Safety
OTTO A. WIESLEY, *Chairman*, Utah State Industrial Commission

Radon Gas Problems in Uranium Mining
MILES P. ROMNEY, *Mgr.*, Utah Mining Assn.

Progress at Algom Uranium Properties
E. B. GILLANDERS, *Managing Dir.*, Algom Uranium Mines, Ltd.

●

1:40 P.M. PRE-SESSION MOTION PICTURE—
"Industrial Research"

2:00 P.M. Stockpiling—Government Mineral Programs

Chairman: A. E. MILLAR, *Gen. Mgr.*, Yerington Mine, The Anaconda Co.

Putting Into Effect a National Minerals Policy
HON. FELIX E. WORMSER, *Assistant Secretary of Interior for Mineral Resources*

Industry Comments on Stockpiling and Government Mineral Programs
OTTO HERRES, *Vice-Pres.*, Combined Metals Reduction Co.
HEWITT S. WEST, JR., *Exec. Vice Pres.*, Manganese, Inc.
FAY I. BRISTOL, Pres., Bristol Silica Co.
JAMES P. BRADLEY, *Vice Pres.*, Bradley Mining Co.
S. H. WILLISTON, *Vice-Pres.*, Cordero Mining Co.
HON. THOMAS E. MARTIN, *U. S. Senator from Iowa*

Outlook for the Defense Minerals Exploration Program
C. O. MITTENDORF, *Administrator*, Defense Minerals Exploration Administration, Department of the Interior

Report of Resolutions Committee:
Tariff, Stockpiling and Mineral Programs

●

1:40 P.M. PRE-SESSION MOTION PICTURE—
"Target Nevada"

2:00 P.M. AEC Policies: Outlook for the Industry

Chairman: MERRITT K. RUDDOCK, *Vice-Pres.*, Cal Uranium Co.

Outlook for Uranium Development and Production
R. G. SULLIVAN, *Vice-Pres.*, Minerals Engineering Co.
HON. STEPHEN L. R. MCNICHOLS, *Lieutenant Governor of Colorado*
G. R. "BUFFALO" KENNEDY, *Special Repr.*, Kerr-McGee Oil Industries, Inc.
BURT B. BREWSTER, *Editor & Publisher*, Mining & Contracting Review

Progress in Atomic Energy and Policies Needed to Maintain a Strong Domestic Uranium Industry
HON. CLINTON P. ANDERSON, *U. S. Senator from New Mexico;* Chairman, Joint Committee of Congress on Atomic Energy

Future of Uranium Consumption
A. J. EARDLEY, *Dean*, College of Mines & Mineral Industries, University of Utah
JESSE C. JOHNSON, *Director*, Division of Raw Materials, U. S. Atomic Energy Commission

Report of Resolutions Committee:
Uranium

●

1:40 P.M. PRE-SESSION MOTION PICTURE—
"Sulphur"

2:00 P.M. Industrial Minerals

Chairman: H. L. WALTHAUSEN, JR., *Works Mgr.*, Blue Diamond Corp.

The Manufacture of Gypsum Products
FRANK L. MARSH, *Asst. to Pres.*, Lauhoff Grain Co.

New Southern California Cement Plant
WILSON C. HANNA, *Vice Pres. in Chg. of Technical Development*, California Portland Cement Co.

Nevada Perlite
O. J. SCHERER, *Consulting Engr.*, Las Vegas, Nev.

Other subjects and speakers to be announced

(*Continued on page* 62)

HOWARD I. YOUNG
President

productions that attract a big turnout at each show. As a special service to Mining Congress visitors the Las Vegas Resort Hotels Association will maintain a Hospitality Desk at the New Frontier Hotel, where reservations may be made for the shows at any of the member hotels. A quota of tables at each show has been set aside for Mining Congress people, but better make reservations early and avoid disappointment.

For the Ladies

Besides the regular Convention events—to all of which the mining ladies are cordially invited—a special program has been arranged for the ladies.

First, there is a welcoming luncheon on Monday, beside the pool in the beautiful patio of the Hotel Riviera.

On Tuesday they'll gather in the Congo Room at the Sahara, for a delicious Brunch followed by a style show featuring the latest in southwestern fashions.

Lake Mead and Hoover Dam will be the center of interest on Wednesday's outing. At the

Directors American Mining Congress

HORACE M. ALBRIGHT

JOEL M. BOWLBY

WORTHEN BRADLEY

LOUIS S. CATES

CHARLES R. COX

ROBERT E. DWYER

RUDOLPH E. ELSTAD

ANDREW FLETCHER

CARROLL A. GARNER

RALPH K. GOTTSHALL

GEORGE B. HARRINGTON

R. A. HUMMEL

Directors (Continued)

(Not Shown)
NEIL W. RICE

HERBERT C. JACKSON

L. RUSSELL KELCE

GEORGE H. LOVE

D. S. MacBRIDE

J. W. OVERSTREET

CHARLES J. POTTER

L. J. RANDALL

RAYMOND E. SALVATI

MERRILL E. SHOUP

HARRIE S. TAYLOR

GUY V. WOODY

Dam, the ladies will have an opportunity to visit the huge power station, housed deep inside the structure, and to see how the Colorado's might is harnessed.

Interesting Trips Planned

The weather in southern Nevada in October is delightful, with warm days and cool nights. It should be ideal for those who go on the field trips on Thursday, October 13, when two special trips have been scheduled.

One of these will be an all-day (9:30 a. m. to 5:30 p. m.) tour to the famous rare earths mining and milling operations at the Molybdenum Corporation of America at Mountain Pass, Calif.

JULIAN D. CONOVER
Executive Vice-President and Secretary

On the second trip, also leaving at 9:30 a. m., visitors will see the noted Three Kids Mine and beneficiation plant of Manganese, Inc. After lunch at Henderson they will tour the plants of the Western Electrochemical Co. and U. S. Lime Products Corp. Western Electrochemical produces battery grade manganese dioxide, potassium and sodium chlorates and perchlorates. U. S. Lime supplies the flux used by the greater portion of the West Coast steel industry. The buses will return to Las Vegas about 4:30 p. m.

(Continued on page 62)

*ACF Industries, Inc.
Allegheny Ludlum Steel Corp.
Allen-Sherman-Hoff Pump Co.
*Allis-Chalmers Mfg. Co.
Alloy Steel & Metals Co.
American Air Filter Co., Inc.
American Brattice Cloth Corp.
*American Manganese Steel Division
American Brake Shoe Co.
American Chain & Cable Co.
*American Cyanamid Co.
American Mine Door Co.
Anaconda Wire & Cable Co.
Armstrong Coalbreak Co.
*Atlas Powder Co.

Baldwin-Lima-Hamilton Corp.
Lima-Hamilton Division
Barber-Greene Co.
Bearing Service Co.
Bethlehem Steel Co.
Bird Machine Co.
Bixby-Zimmer Engineering Co.
Bowdil Co.
Broderick & Bascom Rope Co.
Brooks Oil Co.
Brunner & Lay Rock Bit Corp.
Bucyrus-Erie Co.

Carboloy Department
General Electric Co.
Card Iron Works Co., C. S.
Cardox Corp.
Caterpillar Tractor Co.
Central Mine Equipment Co.
Centrifugal & Mechanical Industries, Inc.

* Charter Members.

Chicago Pneumatic Tool Co.
Cincinnati Mine Machinery Co.
Cities Service Petroleum, Inc.
Clarkson Mfg. Co.
Cleveland Rock Drill Division
Westinghouse Air Brake Co.
Compton, Inc.
Copco Eastern Ltd.
Copco Pacific Ltd.
Cross Engineering Co.
Crucible Steel Co. of America
Cummins Engine Co., Inc.

D-A Lubricant Co., Inc.
Deister Concentrator Co.
Deister Machine Co.
Differential Steel Car Co.
Dings Magnetic Separator Co.
Dorr-Oliver, Inc.
Dow Chemical Co.
Duff-Norton Mfg. Co.
*Du Pont de Nemours & Co., Inc., E. I.

Eastern Car & Construction Co.
*Edison, Inc., Thomas A.
Eimco Corp.
Electric Steel Foundry Co.
Electric Storage Battery Co.
*Elreco Corp.
Engineers Syndicate, Ltd.
Ensign Electric & Mfg. Co.
*Enterprise Wheel & Car Corp.
Euclid Division
General Motors Corp.

Fairmont Machinery Co.
Femco, Inc.
Firestone Tire & Rubber Co.
Firth Sterling, Inc.
Fletcher & Co., J. H.
Flexible Steel Lacing Co.
Flood City Brass & Electric Co.

Gardner-Denver Co.
*General Electric Co.
*Goodman Mfg. Co.
Goodrich Co., B. F.
Off-The-Road Tire Sales
Goodyear Tire & Rubber Co., Inc.
Gorman-Rupp Co.
Gould-National Batteries, Inc.
Guyan Machinery Co.

Harnischfeger Corp.
*Hendrick Mfg. Co.
Hendrix Mfg. Co., Inc.
Hercules Motors Corp.
*Hercules Powder Co.
Hewitt-Robins Incorporated
Heyl & Patterson, Inc.
*Holmes & Bros., Inc., Robert
Hughes Tool Co.
*Hulburt Oil & Grease Co.
Humphreys Investment Co.
Engineering Division

Ingersoll-Rand Co.
International Nickel Co., Inc.
Interstate Equipment Division
Yara Engineering Corp.
Irwin Foundry & Mine Car Co.
*I-T-E Circuit Breaker Co.

*Jeffrey Mfg. Co.
Johnson-March Corp.
*Joy Mfg. Co.

Kanawha Mfg. Co.
Kansas City Structural Steel Co.
Kennametal Inc.
Kensington Steel Co.
Koehler Mfg. Co.

Lake Shore Engineering Co.
Lee-Norse Co.
*Leschen Wire Rope Division
H. K. Porter Co., Inc.
LeTourneau-Westinghouse Co.
*Link-Belt Co.
Long Co., The
Longyear Co., E. J.
Ludlow-Saylor Wire Cloth Co.

*McGraw-Hill Publishing Co.
McLanahan & Stone Corp.
*McNally-Pittsburg Mfg. Corp.
Mack Motor Truck Corp.
Macwhyte Co.
Manu-Mine Research & Development Co.
Marion Power Shovel Co.
Mechanization, Inc.
*Mine Safety Appliances Co.
Mine & Smelter Supply Co.
Mining Machine Parts, Inc.
Mosebach Electric & Supply Co.
Mott Core Drilling Co.
Murphy Diesel Co.
*Myers-Whaley Co., Inc.

Nachod & United States Signal Co.
National Electric Coil Co.
National Malleable & Steel Castings Co.
National Mine Service Co.
Nolan Co.
Nordberg Mfg. Co.
Northwest Engineering Co.

*Ohio Brass Co.
Ohio Carbon Co.
Okonite Co.
Hazard Insulated Wire Works Div.
Olin Mathieson Chemical Corp.
Osmose Wood Preserving Co.

Page Engineering Co.
Pattin Mfg. Co.
Penn Machine Co.
Peterson Filters & Engineering Co.
*Phillips Corp.
Pioneer Engineering Works, Inc.
Pittsburgh Screw & Bolt Corp.
Post-Glover Electric Co.
Productive Equipment Corp.
Prox Co., Inc., Frank

Quaker Rubber Corp.

Raybestos-Manhattan, Inc.
Reich Bros. Mfg. Co.
Reliance Electric & Engineering Co.
Republic Rubber Division
Lee Rubber & Tire Corp.
*Roberts & Schaefer Co.
*Roebling's Sons Corp., John A.
Rome Cable Corp.

*S K F Industries, Inc.
Salem Tool Co.
Sanford-Day Iron Works, Inc.
Schroeder Brothers
Sheffield Steel Division, Armco Steel Corp.
*Simplex Wire & Cable Co.
Simplicity Engineering Co.
Southwestern Engineering Co.
Sprague & Henwood, Inc.
Stearns Magnetic Inc.
Stearns-Roger Mfg. Co.
Sterling Steel Casting Co.
Sun Oil Co.

Talcott, Inc., W. O. & M. W.
Tamping Bag Co.
Texas Co.
Thor Power Tool Co.
Tide Water Associated Oil Co.
*Timken Roller Bearing Co.
Tool Steel Gear & Pinion Co.
Tracy Co., Bertrand P.
Travel Drill Co.
Traylor Engineering & Mfg. Co.
*Tyler Co., The W. S.

Ultra Violet Products, Inc.
Union Iron Works
Union Wire Rope Corp.
*United Engineers & Constructors, Inc.
U. S. Rubber Co.
*U. S. Steel Corp.

Varel Mfg. Co.
Vascoloy-Ramet Corp.
Victaulic Co. of America
Vulcan Iron Works

Wedge Wire Corp.
Western Machinery Co.
Western Precipitation Corp.
Western Rock Bit Mfg. Co.
*Westinghouse Electric Corp.
West Virginia Steel & Mfg. Co.
White Motor Co.
Winter Weiss Co.

PROGRAM

(*Continued from page 57*)

2:00 P.M. Gold and Silver Conference

Chairman: DONALD H. MCLAUGHLIN, *Pres.*, Homestake Mining Co.; Chairman, A.M.C. Gold Producers Committee

The Legislative Outlook for Gold and Silver
HON. ALAN BIBLE, *U. S. Senator from Nevada*

Gold and Its Relation to Convertibility of Currencies
RAY B. WISER, *Pres.*, Walkeng Mining Co.

Silver
SR. ING. GUSTAVO P. SERRANO, *Pres.*, Chamber of Mines of Mexico

Report of Resolutions Committee:
Gold, Silver and Monetary Policy

THURSDAY, OCTOBER 13

9:30 A.M. to 5:00 P.M. Tax Forum (Open to tax accountants and interested mining men)

Chairman: HENRY B. FERNALD, *Chairman*, Tax Committee, American Mining Congress

Two for Price of One

The Rocky Mountain Mineral Conference is to be held in Salt Lake City, October 5-8. Participating in this meeting are five divisions of the AIME, with the Utah section serving as host.

A fine program has been arranged and mining men will be well advised to take in both the Rocky Mountain Minerals Conference and the Mining Congress Convention on the same trip. To make this easy there is a train leaving Salt Lake City at 9:05 a. m. on Sunday, October 9, arriving in Las Vegas at 3:10 p. m. According to advance reports this train should be called the AMC special.

The Las Vegas Housing Committee and the Las Vegas Motel Association advise that they will be able to take care of all comers, but suggest that those who have not yet made reservations call, write or wire immediately. For hotel accommodations contact the Las Vegas Housing Committee, P. O. Box 1750, Las Vegas, Nev. For motel space send your request to Frank Ellis, Sr., Pres., Las Vegas Motel Association, c/o Par-A-Dice Inn, 2217 Fremont St., Las Vegas, Nev.

The American Mining Congress 1955 Metal Mining and Industrial Minerals Convention in Las Vegas October 10-13 is the big mining meeting of the year. Now, when industry problems are pressing for solution, is the time for mining men to get together to help find the answers. Every session will provide a forum where all sides of each question—economic, legislative or operating—will be examined carefully and the way to a solution pointed out. Attendance at the sessions is a "must" for every wide-awake mining man.

On the lighter side Mr. and Mrs. Mining Man can look forward to all the fun and friendship for which Mining Congress Conventions are famous—plus the fabulous attractions of Las Vegas. 'Nuff said?

Flotation plant and surface buildings, Mountain Pass Mine

At Anaconda, we know firsthand the enemies of cable life: water, abrasion, excess tension, run-overs—in our own mines. This experience helps us make better cable for *your* mine use.

Get 300% longer service with Anaconda mine-tested cable

Day-in, day-out mine experience helps us make shuttle car cable that really resists enemies of cable life.

Users tell us today's Anaconda flat-twin cable lasts 3 *times longer* than the cable they used only a few years ago. What makes this Anaconda cable better?

Its jacket is specially compounded neoprene. You can't tear, cut or abrade it easily. Insulation is a new crush-resistant form of rubber, making this cable tougher and vastly more flame-resistant. And an improved stranding and a brand-new ground wire make it a lot safer to handle.

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*Trade Mark

55329

ANACONDA®
MINE CABLE

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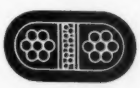


Improved stranding, new insulation, new grounding wire, and neoprene jacket make this a superior cable for shuttle cars, continuous miners, loaders, drill trucks, cutters.

POWER CABLES

AnacondA Types W & G are rugged, sturdy and long-lived. Used for mine power, shovels, continuous miners, loaders, drill trucks, cutters.

SHOVEL AND DRILL CABLES

Securityflex* Types W and G are used with small shovels, self-propelled drill trucks, pumps and a-c mining equipment. For higher voltages, Type SH cables (shielded) are recommended.

SECURITYFLEX CORDS

Unexcelled for strength, wear resistance and long life. Type SO (heavy-duty) provides superior service on remote control and hand drills.

TROLLEY WIRE

FEEDER CABLE BARE OR INSULATED

TELEPHONE CABLE

SHOT-FIRE CORD

WELDING CABLE

A preliminary artist's sketch of the Nation's first central station nuclear power plant at Shippingport, Pa. It is a joint project of the A.E.C. and the Duquesne Light Co. Production of electricity is scheduled to begin in 1957.

Power Reactor Development In the United States

Atomic Power Is Coming But It Is Not Right Around the Corner

By W. KENNETH DAVIS
Director, Division of Reactor Development
U. S. Atomic Energy Commission

PEOPLE are often puzzled by the apparently large number of different routes which are being pursued in the search for economic nuclear power. However, there is a wealth of ideas as how to achieve it. A number of these ideas will be successful. It is too early, though, to determine which of the routes will be most successful. It now seems clear that no single type or class of reactor will satisfy the varied requirements of any one country, not to mention wide areas in the world where requirements may cover every possible combination. Meanwhile, work is being devoted to at least one type of reactor to develop it as an economically competitive generator of nuclear power in at least some areas. This is still some distance in the future, but it will arrive and prospects look brighter all the time.

Present optimism is derived principally from economies possible in the costs of large central-station nuclear power plants, the fabrication of fuel elements for them, and basic cost of the nuclear fuel used. Over-all fuel-cycle costs still present a large and difficult problem and we have only just begun to undertake to solve the problems of small or intermediate size nuclear power reactors. The problems too can undoubtedly be solved, but we do not today have the same feeling of optimism for the solutions.

There have been many conjectures as to when we may expect the atom to become competitive with the fossil fuels in the production of electrical energy. This article by a leading expert on Reactor Development is presented in the belief that it may help answer some of these questions.

This discussion will concern itself with some of the problems in the fuel cycle in the nature of the power reactor program philosophy as related to the "dual purpose" approach.

The Fuel Cycle

One of the most persistent and erroneous ideas concerning nuclear power is that the fuel for nuclear power plants costs practically nothing. Quite the contrary, one of the most difficult problems in the development of economic nuclear power is to get the cost of the fuel cycle down to an acceptable level.

The misconception arises from the fact that on the face of it nuclear fuels are cheap providing that some assumptions are made. If one takes $20 per pound as the price for uranium and assumes that it can all be fissioned in a breeder, then an apparent fuel cost of about 0.005 mills per kilowatt-hour of electricity can be computed. This, if valid, is obviously a truly negligible fuel cost.

It would be encouraging if this type of analysis were true, but it is not. Nuclear fuel costs must be regarded as a very significant and appreciable part of the cost of nuclear power.

Consider what might be included in the fuel cycle of a nuclear power plant. First of all there are the costs of the nuclear fuel itself, that is the cost of the fuel materials less the value of the fuel material recovered and the value of any by-product fissionable materials made.

Secondly, there are the costs of the various operations which are required for the preparation, use, and recovery of the nuclear fuels. These costs are every bit as much a part of the cost of fuel for a nuclear power plant as the cost of the consumed uranium itself.

Among these costs are the cost of fabricating fuel elements, including the materials for alloying or cladding the fuel elements as well as the costs of the manufacturing operations involved. The preparation of fuel elements for power reactors also includes extensive and costly testing operations with the possibility of a high rate of rejection.

The cost of chemical processing must also be charged against the nuclear fuel costs.

Where by-product fissionable materials are to be recycled for fuel use in the reactor, the cost of refabricating fuel elements from such materials as plutonium or uranium 233 must be considered as a part of the fuel cycle costs. Such recycle operations must eventually be carried out if we are to have a large nuclear power industry.

From the point of views of the fuel cycle, reactors may be grouped into two kinds—single region and two-region reactors. In the single region reactor, the fuel is of the same composition throughout. In most power reactors, this fuel would be either natural uranium or uranium with a low degree of enrichment. The irradiated fuel from such a reactor can be processed to recover the fuel material as well as the plutonium made or, if sufficiently long life can be attained, it might be disposed of without processing.

In a two-region power reactor, the central region or core contains fuel material partially or highly enriched in fissionable material. The outer region or blanket contains fertile material such as natural uranium, depleted uranium, or thorium. The core material being very expensive, it must be reprocessed for recovery of the fuel material and any by-product fissionable materials. The blanket material can be processed, or if a very long life is attained, it can be disposed of without processing. The two-region aqueous homogeneous reactor and the fast breeder are examples of reactors of this type.

Nuclear Fuel Costs

A fairly general conclusion which can be reached after studying various types of reactors is that the cost of the nuclear fuel consumed will be approximately one mill per kilowatt-hour though it may be somewhat more or less than that figure depending upon the circumstances. This is not a negligible cost by any means as compared with 2 to 3 mills per kilowatt-hour for conventional fuel costs. Further, it must be pointed out that this is not the total cost of the fuel cycle but only the cost of the nuclear fuel consumed. On the other hand, it must be emphasized that the basic cost of nuclear fuel is not of itself sufficiently high to be a barrier to economic nuclear power. This is an important conclusion and is the result of economics—and not the result of any law of nature!

It is true that in a breeder the cost of the material consumed will become very small, but in such reactors the cost of the fuel cycle itself tends to increase so that one cannot say that the total fuel costs are small. In a breeder both the core material and the blanket material must be reprocessed many, many times in order to obtain reasonably large over-all utilization of the fertile and fissionable materials. In fact, these costs far outweigh the basic cost of the nuclear fuel itself. It must also be pointed out, in a breeder a large initial charge of enriched material is required which must be charged off against the over-all operation of the breeder. This in itself prevents the nuclear fuel costs being as low as sometimes assumed.

Although the prospects for reasonable fabrication costs are now good principally due to the joint AEC industry work in this field, the same cannot be said for the other parts of the over-all fuel cycle where costs now appear to be very high for the cladding and alloying materials proposed in some cases and for the chemical separations and recovery in almost every case.

Although the Atomic Energy Commission has several very large chemical processing plants as well as some small plants, these are not well adapted to carrying out the chemical processing of the very wide variety of power reactor fuel elements which will be used during the next decade or so. These materials, which will be used in a relatively small volume, will be of different degrees of enrichment and of irradiation and will contain many different alloying and cladding materials. They will also be of widely varying sizes and geometrical shapes. The objective of long fuel element life in itself reduces the amount of materials to be processed to a very low amount. Thus, the material to be processed from a 100,000 electrical kilowatt reactor might be only 60 kilograms per day—hardly enough to keep a small pilot-scale processing unit in operation.

A very considerable amount of research and development work has been done by the Atomic Energy Commis-

This huge sphere houses a prototype submarine atomic power plant at West Milton, N. Y. The AEC has announced that the electricity produced during tests will be sold commercially.

sion to find new and better methods of carrying out processing and refabrication for power reactors. Though some of this work looks interesting, we do not yet have any pilot plant experience and cannot evaluate the potential of the processes. We are investigating methods of going ahead with the construction of such plants as chemical processing experiments or as pilot plants, but have not yet decided on the approach to be used.

Private Industry Needed

There is a growing need for chemical processing and refabrication work by industry, not only in the development aspects, but in the provision of plants which can meet the requirements for the next five or ten years. The Atomic Energy Commission will do at least some of the work required, but this will be expensive because the plants are not adapted to the basic requirements of power reactors.

Ingenuity and imagination are required to develop and build small and cheap chemical processing and refabrication plants which will handle a variety of reactor fuel elements each on a small through-put basis. Flexibility at low cost will be the secret of success in this business for some time to come. This appears to be the type of problem which private industry has tackled with success before, and we are hopeful that the methods and incentives of industry will prove equal to this challenge.

The only conclusion which can be reached is that the fuel cycle costs are very formidable today, though we do have confidence that they can be reduced to acceptable levels. In any case, the cost of the nuclear fuel consumed is certainly of the order of one mill, and even under the most favorable circumstances it seems likely the total nuclear fuel cost will be at least two mills per kilowatt-hour when the cost of fabrication, fabrication materials, chemical processing, waste disposal, and refabrication are taken into account. Under circumstances such as those in a breeder, the other costs increase as the costs of the nuclear material consumed decrease, so that the over-all costs do not change very much.

The comments which have been made all presume the value of any fissionable material produced is only that related to its use as a fuel material in a nuclear power plant. Such material will have such value in comparison with the value of the uranium 235 content of natural uranium and the cost of uranium enriched in uranium 235.

The only basis for a higher value for fissionable material produced is its value as a weapons material. If the value for such military use is high, then one can credit the material made at a high price and this price can compensate for the costs of the nuclear fuel consumed, for the cost of fabrication of fuel elements including the special materials used, and the cost of processing and recovering the materials. In fact, in production reactors making no power the cost of the plutonium made is the entire cost. So long as the value for military purposes is larger than the costs, production will continue. This is clearly true at the present time.

Thus, on the one hand, we have appreciable nuclear fuel costs if we ascribe fuel values to fissionable materials produced by power reactors. On the other hand we would say that we have no fuel cost at all if the value for plutonium for weapon uses is as high as the cost of making it. It seems clear that we cannot consider the second case when discussing true nuclear fuel cycle costs.

"Power Only" Reactors

This brings us to the second principal point of this discussion—the nature of our power reactor development program in terms of "dual purpose" versus "power only". It has been argued that the payment of weapons prices for plutonium from dual purpose, power plus plutonium, reactors is an economically sound approach to the development of power reactors. Inasmuch as nuclear reactors are not economically competitive today, the argument is largely one of how economic assistance will be provided.

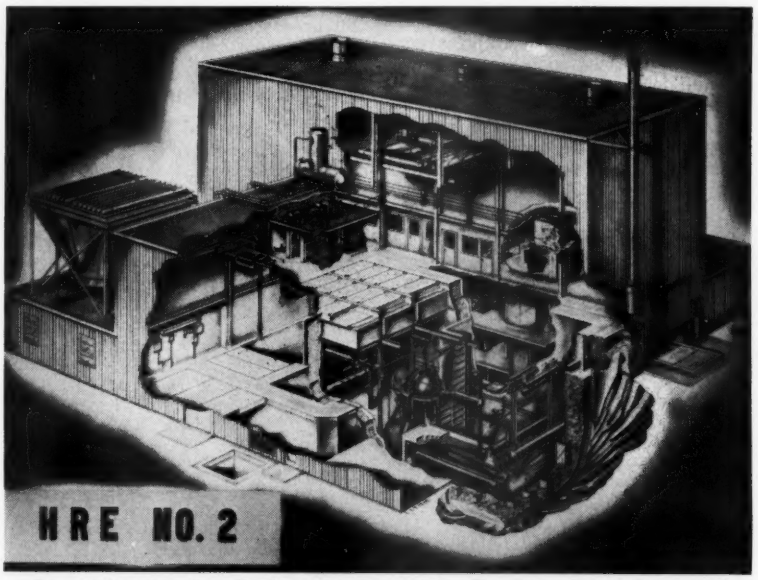
While some temporary encouragement has been given to the production of materials for military use, it has been made clear that "fuel grade" prices for fissionable materials were the most that could be expected over any extended period of time. This is a far-reaching and profound step and one which we believe will result in the quickest attainment of truly economically competitive nuclear power.

It seems clear that a truly economic nuclear power industry must be based on re-use of by-product fissionable material as reactor fuel rather than for weapons purposes. Although there are some difficulties in following the "dual purpose" approach from the general point of view, the compelling reasons are technical or technical and economic. The "dual purpose" route simply is not one which will of itself lead to economic power reactors.

It should be made clear that, in the event more production of nuclear material for weapons purposes is required, there is some value to such reactors also producing power providing such power production actually reduces the cost of the plutonium.

However, there are two difficulties, first, we cannot afford to wait until such a need develops before we undertake the development of nuclear power reactors. Our weapons needs are presumably taken care of by the production reactors now in operation or under construction—none of which will produce any electric power. Secondly, because of the technical aspects, "dual purpose" reactors would not provide the answers to the crucial problems in the development of truly economically competitive power reactors. It would be necessary to carry on a large development program on "power only" reactors in any case to obtain the necessary information.

Power reactors will always have the potential to produce fissionable materials useful for military purposes in



An artist's conception of a homogeneous reactor. The Pennsylvania Power and Light Co. has revealed plans to build a similar reactor by 1962 to produce at least 150,000 kw.

case of an emergency. This is one of the "facts of life" that apply to such reactors wherever they may be located or however they may be designed. They may not be extremely efficient producers if designed for power production, but this will not be of any great consequence if there is a lot of such capacity available.

Dual Purpose Reactors

One of the difficulties with "dual purpose" reactors is that the weapons value of the plutonium made is equal to or in excess of the cost of producing it even though no power is made. This fact makes the emphasis on the economic generation of power very nominal. There is very little economic incentive to make the reactor a good power producer under such circumstances. A small increase in the efficiency of making power will decrease the cost of plutonium only a very small amount.

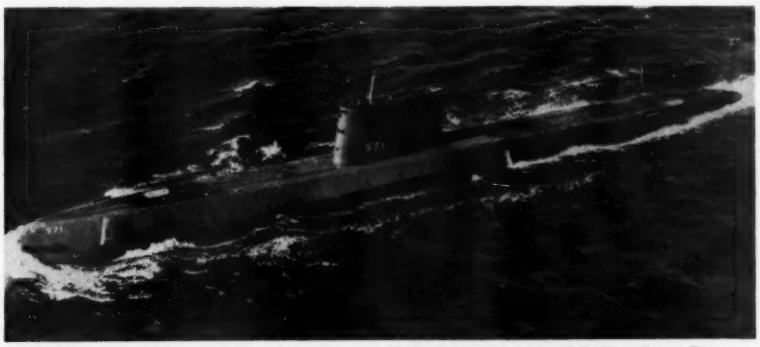
The relative value of the fissionable material produced and the power produced in a "dual purpose" reactor is such that one cannot afford to shut down the reactor when there is no demand for power. The power must be produced and dumped even if no revenue is obtained from it. Such a condition hardly results in realistic consideration of the economics of the power generation.

In some cases, the size of "dual purpose" reactors will be in excess of that desired for power generation use if it is desired to minimize the cost of the fissionable material made. Such large units may be satisfactory where very large blocks of electric power can be absorbed, but this is not generally true in areas where electric power is worth enough to justify the added cost of power production from a production reactor. In other words, adding electric power producing facilities to a production reactor to make it "dual purpose" may actually *increase* the cost of the plutonium made.

One technical difficulty is that temperatures are usually limited by a central fuel element temperature. In a production reactor, the goal is to get as much heat out of the reactor as possible consistent with such a maximum temperature and this is accomplished by having the average coolant temperature as low as possible. This is clearly not consistent efficient power production. In fact, this is the reason why it is often not desirable to try to produce power from a production reactor. The optimum temperatures are often so low that power could not be produced as a by-product.

Where production is of great importance, the design details of the reactor will be changed to favor a high conversion ratio and a high over-all power output. This can be done by adjusting the spacing and size of fuel elements as well as their enrichment.

When electric power generation is the design objective, entirely different detailed designs for the reactor and fuel elements will be found to be required. As Dr. George L. Weil observed in 1953, the design objective for production reactors is conversion ratio, while for power reactors it is the specific power, or the power produced per unit amount of fuel.



The atom has been harnessed to power a U. S. submarine, the S.S. Nautilus. This, though, is a special application and economy was not the prime concern.

In production reactors one is not interested in long fuel element irradiation periods. There is no point in burning up the very valuable fissionable material—plutonium—which has been made by continuing to irradiate it in the reactor. Once the rate of burn-up of the material made becomes appreciable, it is economically desirable to remove it from the reactor. On the other hand, in a power reactor it is very desirable to obtain the longest practicable fuel element life and to burn up the plutonium made since it will only be recycled to the power reactor in any case. There is a vast difference then in the approach to the fuel element problem in "dual purpose" reactors as compared with power-only reactors.

In short, it appears that if one pays high prices for fissionable material produced one will get very good production reactors. On the other hand, if the objective is clearly electric power one should get good power reactors. You get what you pay for!

Inasmuch as nuclear power reactors are not yet economic there must be some assistance either by the Atomic Energy Commission or by industry itself. It should be our objective to be sure that such assistance does not interfere with the traditional cost incentives of private industry nor with the incentive to achieve the best possible power-only reactors as soon as possible.

It is our conclusion that such an approach will lead us to the achievement of truly economic power reactors in the shortest and most direct manner.

The "Chinchilla" Philosophy

In the case of breeder reactors one encounters a special case, which might be called the "chinchilla" philosophy of pricing plutonium. The argument is that if one buys a pair of chinchillas for a thousand dollars or so the money will really roll in as the offspring are sold for breeding purposes to other aspiring chinchilla raisers. This would not be very enticing if chinchillas were only $5 per pair. The catch is that some day the market for breeding chinchillas is going to be saturated and the off-spring of the breeding process will have to be sold for a more utilitarian purpose—making chinchilla coats, for example. Price competition may then reduce the value of chinchillas very markedly.

Now it is the same with plutonium. If one has a breeder reactor or prospects for one that breeds at a satisfactorily high rate, then the higher the price of the plutonium purchased for fuel the more the profit providing that the excess plutonium can be sold to someone else at the same price. This may well be true as long as a lot of new breeder reactors are being built, but ultimately one is going to have to sell some of the plutonium to converter reactor operators—and they are not going to pay much for it since they can buy a better fuel instead, uranium 235, if the plutonium price is not attractive. At this point the whole price structure of plutonium, if it is based on this fallacy, will collapse. We would prefer not to get started with pricing plutonium like chinchillas—you can't even make a coat out of the plutonium!

Conclusions

In conclusion, I would like first to say that I have every confidence we will solve the problems of economic nuclear power not only for large central-station reactors but for small power reactors as well. However, such achievements are some distance off and will require the closest cooperation between the Atomic Energy Commission and American industry. We are making progress at a surprising rate but a great deal remains to be

(Continued on page 98)

Good track, good roof support, good drainage, good maintenance—all are part of good haulage

Considerations in Designing a Mine Haulage System—Part II

Don't Stop After Engineering Haulage Equipment—Permanent Features Also Deserve Careful Study

By STEPHEN KRICKOVIC
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BESIDES haulage equipment as such, which was discussed in Part I of this series, the permanent features on the haulway should also be considered in the light of the need for an uninterrupted flow of material.

In the design of a general projection for a new mine or a revamped old mine, the need for the shortest possible haulway should receive serious consideration.

To permit with reasonable safety a trip speed of 12 to 15 mph, the haulway heading should be driven to provide the necessary clearances, and should be timbered, wherever required, without wood, steel or masonry supports from the floor. This means that only roof bolting or the so-called pin timbering should be used wherever practical.

I'm familiar with a mine in which the main line haulway was excellently timbered with 6 by 8-in. locust headers on eight-in. locust posts, the sets being placed on four-ft centers. Despite the fact that the 85-lb thermit welded track is well constructed, wrecks of main line trips during the past 10 years have kicked out timber sets and caused falls to the extent that approximately three miles of the haulway have been retimbered. Fortunately, no one was seriously injured in any of the wrecks. Damage to locomotives and mine cars, clean up of falls and retimbering, and reduction in production, however, made the cost suffer. A conservative estimate for all extra charges would be a total of $150,000 to $200,000 for the three-mile stretch.

A word of caution needs to be injected here about roof bolting of the main line. If the roof tends to spall, and many roofs do, there is danger that bolts will loosen due to loss of contact between the steel plates and the spalling rock. This damaging effect will be somewhat lessened if wood headers or steel channels are bolted. In any case, thought should be given to the possibility of sealing the roof after bolting.

The Roadbed and Grades

It is not practical to establish final haulway grades in virgin areas from drill hole or outcrop opening records. This data, while very desirable and necessary, can serve only as a guide and a control. A method of developing main headings should be devised, particularly at mines in which grade undulations are appreciable and abrupt, so that an advance of at least 1000 ft can be made before the final grade is set to fit in with the preceding finished section. Otherwise, the chances are too great for rock work and for many breaks in grade.

A practical method of obtaining the proper development ahead of the permanent track in the thinner seams is to drive the mains with the use of a belt conveyor. I know of one such installation which has been in very successful use for about five years. The common objection to the idea is that the tonnage of coal produced for the money spent on the belt installation is too low. I believe if all the factors involved are properly considered, the belt idea would be well justified in many cases.

In thicker seams, the job is accomplished by building first a temporary track without top or bottom grading in the heading adjacent to the main

haulway. When the 1000 ft or more of the main line is constructed, the temporary track opposite it is removed for use ahead. By thus having at least 1000 ft of heading surveyed for alignment and grades, it becomes practical to determine the economic grade for the section with sufficient margin for the next 1000-ft section.

Track and Trolley

Eighty-five lb rail laid on 6 by 8-in. creosoted ties with crushed limestone or cinder for ballast has been evolved, generally, as a standard for heavy and fast haulage equipment. Also, thermit and electric welding of joints is rapidly displacing the bonded joint, and is providing a continuous running surface and power return.

In order to maintain the track in good alignment, it is very important to drain the roadbed adequately. This is an item that must be engineered with the haulway and the track, and not wait until some damage has been done. The drainage can be accomplished by properly located ditches, or small sumps with pumps or by combination of the two.

As a part of the permanent haulage fixtures, the trolley wire is also a very important item. It must be hung at a uniform elevation above the rail and on the same alignment as the track, but at a required distance outside of the rail. Wherever possible it should be so supported from the roof as to provide a flexible surface to the trolley wheel or slide at the support. This can be done, when both a feeder and trolley are used, by supporting from the roof hanger only the feeder at certain intervals and by clamping together the feeder and trolley at shorter intervals. Trolley wire thusly constructed will reduce considerably the dangers of the trolley pole disengaging from the wire and causing a possible accident to a fast moving trip.

Long radius curves—300 ft to 500 ft—No. 6 to No. 8 turnouts, and super-elevation of outside rail on curves complete the features of fast haulage track.

Control of Trips

The ideal in main line haulage is continuous movement of empty and loaded trips at the maximum designed speed and with a minimum of time spent at the two terminals. While this goal is impractical to attain totally, much can be done, in addition to what has been already described, to approach it rather closely. This involves items of control which will reduce to a minimum, or eliminate completely, haulage delays and will at the same time, reduce the possibilities for wrecks. The controls can be summarized as follows:

(a) Dispatchers
(b) Trolley-phones—placed on all locomotives and jeeps, in dispatcher's office, in the inside repair shop and at the car dumping point
(c) Telephones—placed at all strategic locations in a mine, including all producing sections
(d) Automatic system of block signals
(e) Automatically actuated track switches and trolley frogs
(f) Automatically actuated derails

Whether some or all of the listed controls are adopted will depend upon several factors, such as, the total tonnage, the number of locomotives in use, the length of haul, the interval of time between shifts, and whether a main repair shop is located inside. Each item of control performs a valuable time saving and safety service, and all may be advisable to incorporate into the haulage system at certain mines. Obviously there would be overlapping, but this might be justified as insurance against a possible costly human and equipment failure. The success of the total control system will depend upon proper operation and maintenance of the various parts, which means employment on full time basis of a competent service man or two.

Power

Adequate power is, of course, an obvious essential for main line haulage. If substations are planned systematically for mining, it will be easy and satisfactory to leave certain ones in place for the main line after mining has progressed beyond the stations. However, because the main line haulage duty is somewhat different from the combined duty in a section, consideration might be given to replacing with a less costly and more appropriate type the conversion unit, which later can then be moved ahead for regular section duty.

Further, to insure against unnecessary stoppage of main line locomotives and to safeguard against possible fire from accidental contact of trolley wire with loaded mine car, particularly when it is standing on a sidetrack, sectionalizing circuit breakers can be installed. This, of course, would be done in conjunction with similar sectionalizing of the various producing areas, and the entire system would then be properly balanced as to circuit breaker settings.

Single or Double Track?

A study of haulage would be incomplete if it didn't include some discussion of the subject of double track. Whether to build or not to build a second main line is generally a difficult problem to resolve satisfactorily because of the many ramifications of a haulage system, because of the changing inside conditions and because of the fact that decisions on the permanent haulage system are often delayed too long.

On the other hand, there are certain physical factors in a mine which help to point the way. They are the daily production, the main portal location, the variations in quality of coal and per cent rejects in different major areas, and the fluctuations in seam thickness and in grades. These factors will sooner or later divide the mine, for the best over-all economic life, into at least two smaller mines. In such cases, a section of the main line is common to all areas in the mine, with the remaining sections of the haulway being used for 30 per cent to 70 per cent of the total daily production.

Usually, the common stretch of the main line is the easiest to decide to double track, unless it is longer than say two miles and considerable slating and timbering is required for the second haulway. The problem then must be reviewed in the light of other uses of the particular section of the main haulway. If repair and supply

Trip control is dictated by several factors and each mine offers its own special problem

crews, and man trips must travel over it, considerable delay in haulage could result with consequent higher mining costs.

However, if the man portal is located close to the producing areas, and the repair shop is inby the haulway in question, there might be an opportunity for an arrangement less costly than the second haulway. For instance, let's assume that an assembly yard is constructed 2½ to 3 miles from the car dumping point in Mine "A" with the two 34-ton locomotives hauling the 3000 tons of material per shift in use. Purchase of a third 34-ton locomotive would make possible the use of two of these units per train to haul a thirty 15-ton car trip or a forty-five 10-ton car trip from the assembly yard to the car dumping station. This is equivalent to a capacity per shift of 4000 tons of materials. The third locomotive would be used to haul from the assembly yard to the main sidetracks and would be assisted by the double units in hauling the 3000 tons of materials. There is a very good possibility that the three locomotives and two crews (four men) could accomplish the job satisfactorily. The extra capital expenditure for the locomotive and the assembly yard would be about $90,000, which is to be compared with an approximate expenditure of $245,000 for slating, grading, permanent timbering, laying of 85-lb. track with thermit welded joints on 6 by 8-in. creosoted ties and hanging of nine section trolley wire in the 13,000 ft long haulway.

The advantage of the extra locomotive over the double track would, of course, be reduced and possibly eliminated in the same seam if the sidetracks at belt loading points are located in the heading immediately adjacent to the main haulway. Since roughly 60 percent of the heading would be slated for sidetracks, the cost of converting it into a second main haulway would be considerably less than for the main haulway, especially if grading is provided for loaded cars only. This point about grading and constructing the second haulway is rather controversial among mining people. Those who would make it identical to the first contend that in case of an emergency requiring the use of the second haulway, there would be no change in size and speed of trips. Others question the advisability of spending the extra money just to handle an emergency.

Other conditions under which the above-mentioned advantage of the extra locomotive would be reduced or eliminated compared to double track are moderate seam undulations and seam thickness of five to eight ft. In these cases, the haulway construction cost might be reduced by 20 to 40 percent.

Looking at the total main line haulage picture, I believe three basic plans will cover most of the mines. These are:

(1) Single main line track throughout, with one or more passing tracks and with partial or complete controls such as trolleyphones, telephones and signal block system.

(2) Double track to a point that would involve 70 percent or more of the total daily production, with the remainder of the haulways being single tracked and provided with passing tracks and or partial or complete controls.

(3) Single track in the "common stretch" for use of one main line locomotive, with an assembly yard at the end of the "common stretch," and single track in the remaining haulways with passing track or tracks and partial or total controls. This plan might also include some length of double track inby the assembly yard.

Grade and line surveys should be kept well ahead of permanent track installation so that a practical economic haulway grade can be selected for the permanent installation

Summary

All the foregoing considerations in the design of a main line haulage system may be generally summarized as follows:

(1) General projection of the mine and progress for life to determine the location and the extent of the main line.

(2) Type and number of mine cars to be used, with emphasis on factors affecting operating and maintenance costs.

(3) Type, size, number and general specifications of main line locomotives to be used.

(4) Advisability to use intermediate haulage.

(5) Specifications of a fast speed haulway with respect to—
   a. Over-all dimensions of heading and timbering of it.
   b. Roadbed and grades.
   c. Track and trolley.
   d. Controls, including dispatchers, telephones, trolleyphones, automatic block signal system, and automatically actuated track switches, derails and trolley frogs.
   e. Power with sectionalizing circuit breakers.

(6) Advisability to use single or double track haulage.

All belt haulage has not been included in this analysis. That system may be preferable to all track haulage under certain conditions. The subject is broad and important in its own right and deserving of separate handling.

In conclusion, it is to be noted that the design of a suitable and economic main line haulage system for a mine must include a thorough engineering analysis of all factors involved. Each mine, with its various physical conditions and operating problems, will require special treatment for the most part. There is no standard formula applicable to all mines, and that is especially true today with the increasing emphasis that is being focused on heavier and faster moving trips. To undertake the job in any other manner would be inviting the possibility of inefficient operation and loss of money.

The mill at Riddle, Ore., presents a busy picture as nickel mining in the United States becomes a reality

Operations Research Applied To Ore Reserves at Riddle

Test Reliability of Ore Estimates by Using Combined Talents of Mining Engineer, Geologist, Logician and Mathematician

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FOR a number of years The Hanna Coal and Ore Corp. has carried on laboratory and pilot plant research in an effort to extract nickel from low-grade ore in this country. Rights to the ore deposit of nickel laterite at Riddle, Ore., the largest known deposit of its kind in the United States, were obtained by the Hanna Co.; and during 1951 and 1952, exploration and metallurgical research were sufficiently encouraging to justify the company's entering into contracts with the Defense Materials Procurement Agency to develop the deposit. In 1953, work was begun to prepare the property for mining and to construct a plant for converting the low-grade ore into ferronickel.

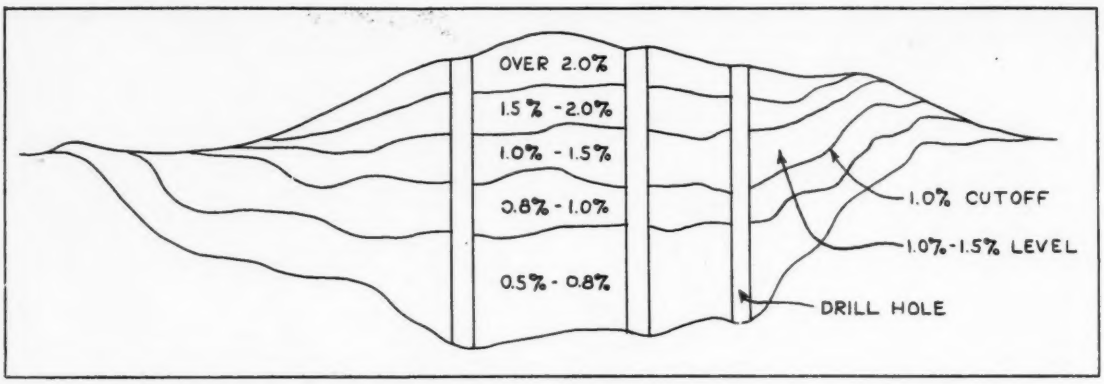
The mine, located at the top of Nickel Mountain, is operated by open-pit methods, and the ore is transported over an aerial tramway to a plant located at a lower level. At the plant, the ore is dried, crushed, calcined and melted in large electric furnaces. Nickel and some iron are then reduced from the molten ore, and the impurities in the metal produced are removed by refining in an electric furnace. The final product is in the form of ferronickel pigs weighing about 50 lb each.

The Riddle project is important to the national economy because nickel is a critical metal. Under the contract with the government, the entire production of the plant will be purchased by the government until June 1962, or until a specified tonnage of nickel has been delivered, whichever occurs first.

Apply Operations Research

Although geological, mining and pilot plant smelting evaluations had indicated a favorable mining and refining operation based on an estimated nickel content of the deposit, a need was felt for a scientific measure of the reliability of that estimate. What degree of confidence could be placed in a prediction that the actual nickel content of the ore when mined would fall within a specified range? In other words, could evidence be obtained from existing drilling data to support in a probability sense the hypothesis that actual mining results would not show deviations in excess of a given amount from the estimate? This paper reviews the methods that were used to answer the question of reliability.

The study was made at the suggestion of Dr. J. K. Gustafson, Vice President, The Hanna Coal & Ore Corp. Work was carried out by the Operations Research Group of Case Institute of Technology in collaboration with Hanna personnel, including G. D. Creelman, Research Coordinator of The M. A. Hanna Co., and Dr. Andrews, Geologist, who worked as a member of the Operations Research Group in Cleveland. Acknowledgments are made to A. T. Broderick, formerly with The M. A. Hanna Co., and now Chief Geologist of The Inland Steel Corp., who produced the original estimates; and to Dr. A. E. Walker, Chief Geologist of The M. A. Hanna



Orebody is like a stack of oval plates, biggest and leanest at bottom—smallest, richest on top

Co., who made many helpful suggestions during the course of the investigation.[1]

The Riddle Deposit

The existence of the Riddle Nickel Deposit has been known for many years, but until the demand for nickel became urgent the deposit had not been considered attractive commercially. The ore body, roughly oval in plan, is about a mile long and a half mile wide, and has very little overburden. Drilling indicates that the central portion is fairly rich in nickel to relatively great depths, with rings of progressively shallower zones of lesser nickel content.

During the Tertiary period basic intrusive rocks containing minor amounts of nickel were deeply weathered. Lateritization chemically reduced the primary minerals of the nickel-bearing intrusive to more stable minerals. Among these was the secondary nickel mineral garnierite. Seemingly gentle erosional forces over a long period of time carried the finer and more soluble decay products out of the weathered laterite, leaving behind a concentration of garnierite. Local fracture zones aided deeper penetration of ground water, resulting in a noticeably deep "keel" in the south-central portion of the deposit. Subsequent to the major enrichment period, more youthful erosion dissected the area, but left the top of Riddle Mountain as a remnant of the major lateritization period.

Essential features of the ore body at the present time could possibly be illustrated by a stack of oval dinner plates arranged in order of size and value with the largest and least valuable at the bottom, and the smallest and most valuable on top. A covering cloth could represent the present surface overburden.

[1] Among those who were most helpful in defining the problem, suggesting methodology, and critically evaluating results of the team effort were Dr. C. West Churchman and Dr. R. L. Ackoff of the Case Institute of Operations Research Group. A large portion of the statistical calculations were made by Herbert Eisenberg, a member of that group.

Data for the Study

Churn drilling by a previous lease holder had been concentrated for the most part in areas of apparently high nickel content. Further drilling and trenching by the Hanna Co. extended and more precisely defined the limits of lower grade deposits, and outlined the area that appeared to be, at least, of high enough grade for smelting. The earlier drill holes were rather haphazard in pattern, whereas the later holes were more regularly spaced over the area.

The fairly consistent tendency toward lower nickel content at greater depths was indicated by analysis of approximately 5000 drill hole samples of five-ft intervals from 87 holes. The values 0.5, 0.8, 1.0, 1.5, and 2.0 percent were arbitrarily selected as "cut-offs" in the ore body for purposes of classification and estimation. By drawing contours of equal values from hole to hole, cut-off "levels," or curved "shells" of assumed equal value were established on maps. In view of the economics of the planned mining operation, one of these cut-offs was so chosen that the average nickel grade of all material above it would be acceptable, provided, of course, that the estimated grade was correct.

From the drill hole data and the maps and cross-sections, the volume of each level was calculated. These volumes were determined by the polygon method. The height of each polygonal prism was taken as the distance in the drill hole between consecutive cut-offs. The totality of the products of each polygonal area by its associated height was taken as an estimate of the volume of each level.

The company's estimate of the grade of the ore in each polygonal prism was taken as the arithmetic mean of the percentages of nickel in the five-ft samples taken from that prism. The total estimated nickel content for each level was then obtained as the weighted (by volume) average of the individual prism estimates. Arithmetic calculations were then made to estimate the grade and the tonnage of nickel above each of the several cut-offs.

Reliability of Estimates

Nickel content of each level (0.5-0.8, 0.8-1.0, percent etc.) was estimated statistically and independently of geological estimates in two ways. In one, the estimate of the mean nickel percentage for a level was taken as the average of all sample percentages (5-ft interval analysis) for that level. But under the assumption that samples taken at random would be representative (within probability limitations) of the entire level from which they were taken, this estimate would be biased because of the concentration of drill holes in the apparently richer areas. To reduce this bias, a second estimate was made after first making a transformation of the data. This transformation was accomplished after imposing a grid over the surface map of the ore body so as to satisfy statistical requirements for randomness and to take into account the concentration and spacing of drill holes throughout the area covered.

The grid was composed of cells of

Ore is carried by aerial tram from mine to mill

equal areas so shaped that at least one drill hole was included within each cell. For each cell that included more than one drill hole, corresponding sample percentages of nickel were averaged, and a single representative drill hole was constructed. Estimated means were then computed by cells in which n is the number of samples taken from the level. The 95 percent confidence range was then found by reference to a table of the normal probability distribution. For example, the sample mean for the 1.0-1.5 percent level was found to be 1.263 percent, and the standard deviation of the 532 samples for this level was found to be 0.369 percent. Then the standard deviation of the mean for this level was calculated as $0.369/\sqrt{532}$, or 0.0160 percent. At the 95 percent probability level for a normal distribution the number of standard units is 1.96. Hence, 1.263 percent $\pm$ (1.96) (0.0160 percent), or 1.263 percent $\pm$ 0.0314 percent was taken as the 95 percent-confidence range for the mean percentage of nickel between the 1.0 and 1.5 percent cut-offs. That is to say, it is reasonable to have 95 percent confidence that the interval 1.2316 percent to 1.2944 percent contains the actual mean nickel content of this portion of the ore body.

To estimate the mean nickel content above the separate cut-offs, the level means were weighted by the corresponding volumes of the levels. Then the standard deviations of the combined means were calculated by formula. Table II gives the estimated

TABLE I.—Estimated mean nickel percentage for each level

(Uncorrected for Bias)

Level %	Number of Samples n	Estimated Mean Percentage of Nickel $\overline{X}$	Standard Deviation of Mean $S_{\overline{X}}$	95% Confidence Range $\overline{X} \pm 1.96\, S_{\overline{X}}$
0.5–0.8	319	0.647	0.0099	0.6297 to 0.6643
0.8–1.0	188	0.879	0.0208	0.8382 to 0.9198
1.0–1.5	532	1.263	0.0160	1.2316 to 1.2944
1.5–2.0	184	1.693	0.0302	1.6338 to 1.7522
Over 2.0	281	2.504	0.0737	2.3600 to 2.6480

for the several levels, and these were then weighted by volumes between successive cut-offs to give estimates of nickel content within each level and above the several cut-offs. The reliability of these estimates was then determined by statistical analysis.

(a) Data Uncorrected for Bias

In making this preliminary estimate the individual means for each level were weighted by the ore body volume of each level so as to yield an estimate of the mean nickel content above any given cut-off. Then under the assumption of normality of distribution of samples within the ore body, the reliability of the estimated means was calculated for the individual levels and for the portions above each cut-off. Table I gives the estimated mean percentage of nickel for each level together with the reliability of the estimate at the 95 percent confidence level. Statistically, this means that if one were to repeat the drilling in a similar fashion, he would expect the estimated mean nickel content to fall within the ranges indicated in the table 95 percent of the time. This corresponds to a measure of the risk involved in the actual mining operation, and was felt to be satisfactory as a basis for the decision to proceed with the project.

The estimated mean, $\overline{X}$, for each level was calculated from the distribution of samples for each level. Then using the standard deviation, S_X, of the distribution (not shown in the table), the standard deviation of the mean, $S_{\overline{X}}$, was estimated by the formula

$$S_{\overline{X}} = \frac{S_X}{\sqrt{n}},$$

TABLE II—Estimated mean nickel percentage above each cut-off

(Uncorrected for Bias)

Cut-off %	Estimated Mean Percentage of Nickel Above Cut-off $\overline{X}$	Standard Deviation of Mean $S_{\overline{X}}$	95% Confidence Range $\overline{X} \pm 1.96\, S_{\overline{X}}$
0.5	1.0976	0.0090	1.0798 to 1.1056
0.8	1.2733	0.0119	1.2500 to 1.2966
1.0	1.4664	0.0146	1.4378 to 1.4950
1.5	1.9576	0.0318	1.8959 to 2.0193
2.0	2.504	0.0737	2.360 to 2.648

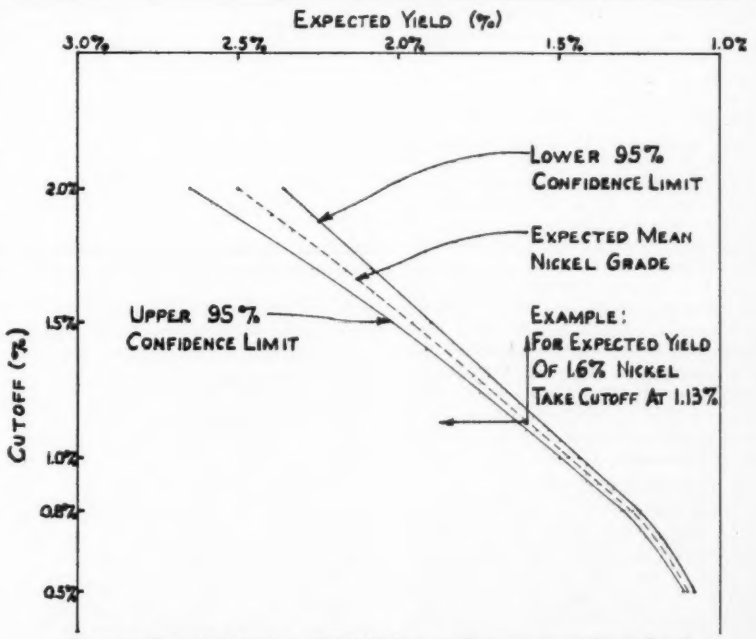


Chart 1—Expected yield vs. Cutoff Plotted at 95 percent confidence level

mean nickel percentage above each of the separate cut-offs together with the reliability of these estimates at the 95 percent confidence level.

To illustrate the calculations for the estimates in Table II, let us consider the 1.0 percent cut-off. The estimated mean nickel percentage above this cut-off and the reliability of this estimate were computed as follows:

Using the appropriate means in Table I and volume figures that were readily available from simple arithmetic calculations, the following figures were assembled:

Level	Means ($\bar{X}_i$)	Volumes (V_i)
Over 2.0 percent	2.504 percent	44,170,000 cu ft
1.5–2.0	1.693	70,530,000 cu ft
1.0–1.5	1.263	252,870,000 cu ft

For the estimated mean nickel content above the 1.0 percent cut-off, the weighted mean, $\bar{X}$, was, therefore,

$$\bar{X} = \frac{1.263(252,870,000) + 1.693(70,530,000) + 2.504(44,170,000)}{44,170,000 + 70,530,000 + 252,870,000} = 1.4664 \text{ percent}$$

Using the appropriate standard deviations of mean in Table I and the volume figures listed above for the three levels above the 1.0 percent cut-off, the standard deviation of the mean of 1.4664 percent was obtained by substitution in the formula

$$S_{\bar{X}} = \frac{\sum_{i=1}^{3} S_{X_i} V_i^2}{\sum_{i=1}^{3} V_i^2}$$

and was found to be 0.0146 percent. Multiplying this standard deviation by 1.96 for the 95 percent confidence level, we find 0.0286 percent; that is to say, we should expect 95 out of 100 similarly assembled sample data from drilling information to yield means of nickel content in the range 1.4664 ± 0.0286 percent, i.e., 1.4378 percent to 1.4950 percent. The estimated mean nickel content above each of the other cut-offs and the reliability of each of these means were calculated in a similar fashion. A chart for determining cut-off to correspond to a given estimated mean grade of nickel is shown in Chart 1. For example, if it were desired to obtain with probability 0.95 a mean nickel content of 1.6 percent from excavated ore, one reads from Chart 1 that the mining should extend to a depth corresponding to a cut-off of 1.13 percent.

(b) Data Corrected for Bias

When the data were transformed so as to remove the effect of bias due to concentration of drilling information in those areas where there was indication of the richer nickel content, there resulted a decrease in the number of samples in certain levels, and the estimates of mean nickel content and corresponding reliability indices had to be adjusted. The estimates for each level are given in Table III, and the estimates for portions of the ore body above each cut-off are given in Table IV.

The grid that was placed over the map of the ore body for the purpose of equalizing the effects of unequal drilling information was composed of 29 cells of equal area. For each of these cells the mean nickel content by level was estimated by a weighted mean of the samples for individual drill holes. Thus, for a given cell, c, and the j-th level, the estimated mean, $\bar{X}_{cj}$, was calculated by the formula

$$\bar{X}_{cj} = \frac{\sum_{i=1}^{k} n_{ij} \bar{X}_{ij}}{\sum_{i=1}^{k} n_{ij}}$$

in which n_{ij} is the number of samples from that portion of the i-th drill hole that passed through the j-th level, $\bar{X}_{ij}$ is the mean of these samples and k is the number of drill holes in the cell, c. These estimates for all cells throughout a level were then averaged to yield the estimated means shown in Table III, and the standard deviation of each of these means was computed by appropriate formula.

As in (a), the estimate of the mean nickel content in the ore body above each cut-off was obtained by weighting the level mean with the volume of the corresponding level. These estimates and their reliability are given in Table IV.

Drilling Required for Stated Reliability

In studying the reliability of the estimates of the nickel content of the ore body, there arose the question as to whether additional drilling would be required, or whether the number of holes already drilled was enough, or more than enough, for stated levels of reliability. The results of this part of the study indicate the value of economic utilization of drilling information and efficient design in the drilling pattern.

It turned out that on certan levels additional drilling would be required if interest were directed to those levels only; on others, no additional drilling was necessary; and in some cases, over-drilling was indicated. Calcula-

TABLE III—Estimated mean percentage of nickel for each level

(Corrected for Bias)

Level	Number of Samples	Estimated Mean Percentage of Nickel	Standard Deviation of Mean	95% Confidence Range
%	n	$\bar{X}$	$S_{\bar{X}}$	$\bar{X} \pm 1.96\, S_{\bar{X}}$
0.5–0.8	289	0.628	0.0130	0.6025 to 0.6535
0.8–1.0	188	0.883	0.0224	0.0438 to 0.9268
1.0–1.5	510	1.259	0.0169	1.2259 to 1.2921
1.5–2.0	173	1.674	0.0335	1.6083 to 1.7397
Over 2.0	281	2.472	0.0736	2.3277 to 2.6163

TABLE IV—Estimated mean percentage of nickel above each cut-off

(Corrected for Bias)

Cut-off	Number of Samples Above Cut-off	Estimated Mean Percentage of Nickel Above Cut-off	Standard Deviation of Mean	95% Confidence Range
%	n	$\bar{X}$	$S_{\bar{X}}$	$\bar{X} \pm 1.96\, S_{\bar{X}}$
0.5	1441	1.0886	0.0098	1.0694 to 1.1078
0.8	1152	1.2682	0.0126	1.2435 to 1.2929
1.0	964	1.4568	0.0153	1.4268 to 1.4868
1.5	454	1.9345	0.0330	1.8698 to 1.9992
2.0	281	2.4723	0.0736	2.3280 to 2.6166

tions of required sample size (amount of drilling) for different levels of reliability were made under the assumption that the standard deviations in Table IV were unbiased estimates of the standard deviations of all possible samples within the ore body.

The calculations in Table V are for a required reliability (standard error of the mean) of $S^*_{\bar{X}} = 0.015$; and those in Table VI for the slightly less stringent requirement of $S^*_{\bar{X}} = 0.020$. In these tables, Column (1) shows the value of $S_{\bar{X}}$ obtained from the drilling data for each level and above each cut-off. Column (2) shows the number of samples taken, and Column (3) shows the required sample sizes for the two required standard errors. Column (4) shows the amount of additional drilling (or over-drilling) corresponding to the required reliability. For example, in Table V we read $n - n' = +39$ opposite the 1.0 percent cut-off, which means that 39 additional samples (195 ft) should be drilled at random above the 1.0 percent cut-off to meet the requirement of $S_{\bar{X}} = 0.015$. The entry, $n-n' = -339$, opposite the 0.8 percent cut-off indicates that the ore body above that cut-off had been over-drilled to the extent of 339 times 5 ft, or 1695 ft.

The required sample sizes, Column (3), in Tables V and VI were determined by solving for n' in the formula

$$S^*_{\bar{X}} = \frac{S_X}{\sqrt{n'}}$$

in which S_X was first estimated from the values of n and $S_{\bar{X}}$ given in Columns (1) and (2), and $S^*_{\bar{X}}$ is the required standard error of the mean. For example, above the 1.0 percent cut-off (Table V) $n = 964$ and $S_{\bar{X}} = 0.0153$. Hence, an estimate of S_X, the standard deviation of the sample above this cut-off, is given by

$$S_X = S_{\bar{X}}\sqrt{n} = (0.0153)(\sqrt{964}) = 0.4750.$$

Substituting this value in the formula above with $S^*_{\bar{X}} = 0.015$, we have

$$0.015 = \frac{0.4750}{\sqrt{n'}}$$

from which we find $n' = 1003$, the required sample size above the 1.0 percent cut-off for a reliability of $S_{\bar{X}} = 0.015$.

The actual number of samples taken from above this cut-off was 964. The difference, 1003 — 964, or +39, indicates the additional number of drill hole samples that would be required.

It will be noted for the lower levels, and correspondingly for the portions of the ore body above the lower cut-offs, that the differences in the values of n tend to be negative, indicating over-drilling in these portions. Above the 2.0 percent cut-off, a rather large amount of additional drilling is indicated for the stated reliability requirements. If mining were to be confined to that portion of the ore body above the 1.5 percent cut-off, much additional drilling is also indicated. For an operation extending to the depth of the 1.0 percent cut-off, however, there is little or no evidence for the necessity of further drilling to be assured that the mean grade of nickel as mined will be within 0.03 percent to 0.04 percent of the estimate.

TABLE V—Sample sizes required for reliability $S^*_{\bar{X}} = 0.015$

	(1) Standard Deviation of Mean Obtained from Drilling Data $S_{\bar{X}}$	(2) Number of Samples Taken n	(3) Number of Samples Required n'	(4) Difference in Number of Samples n−n'
Within Level				
0.5%–0.8%	0.0130	289	216	− 73
0.8%–1.0%	0.0224	188	420	+ 232
1.0%–1.5%	0.0169	510	640	+ 130
1.5%–2.0%	0.0335	173	864	+ 691
Over 2.0%	0.0736	281	6773	+6492
Above Cut-off				
0.5%	0.0098	1441	615	− 826
0.8%	0.0126	1152	813	− 339
1.0%	0.0153	964	1003	+ 39
1.5%	0.0330	454	2197	+1743
2.0%	0.0736	281	6773	+6492

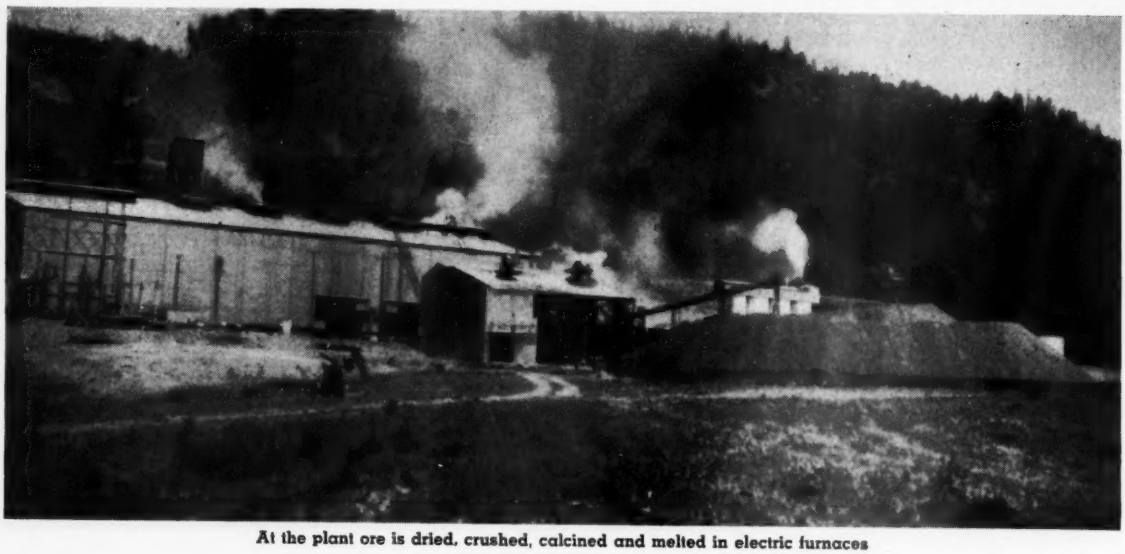
TABLE VI—Sample sizes required for reliability $S^*_{\bar{X}} = 0.020$

	(1) Standard Deviation of Mean Obtained from Drilling Data $S_{\bar{X}}$	(2) Number of Samples Taken n	(3) Number of Samples Required n'	(4) Difference in Number of Samples n−n'
Within Level				
0.5%–0.8%	0.0130	289	122	− 167
0.8%–1.0%	0.0224	188	236	+ 48
1.0%–1.5%	0.0169	510	361	− 149
1.5%–2.0%	0.0335	173	486	+ 313
Over 2.0%	0.0736	281	3807	+3526
Above Cut-off				
0.5%	0.0098	1441	346	−1095
0.8%	0.0126	1152	457	− 695
1.0%	0.0153	964	564	− 400
1.5%	0.0330	454	1236	+ 782
2.0%	0.0736	281	3807	+3526

Summary and Implications

An Operations Research team, composed of members of the Operations Research group of Case Institute of Technology and personnel of the Hanna Coal and Ore Corp. estimated the nickel content of an ore body located at Riddle, Ore., and determined the reliability of the estimate. Data for the study were taken from drilling information, and statistical procedures were prominent among the techniques used in the analysis.

The research led to a study of the relationship between cut-offs in the ore body and the expected mean grade of nickel above different cut-offs. The company had previously made estimates based on drilling data and geological evidence, but it had no measure of the reliability of estimated yield. After making certain assumptions about the ore body in the light of available evidence, the team esti-



At the plant ore is dried, crushed, calcined and melted in electric furnaces

mated the nickel content for various levels of mining, and placed probability confidence limits on these estimates.

The study is an example of one of the potential uses of scientific methodology in mining exploration and operation. It illustrates an application of statistics in preparing information for executive action by providing a quantitative basis for confirming the experienced geologists' conclusion that enough drilling had been done.

A basic principle of Operations Research is to use the combined abilities of different kinds of experts to define and solve a problem. This principle gives increased assurance that consideration is given to all the critical factors upon which valid conclusions are based. In this study the geologist and the mining engineer joined forces with the logician and the mathematician in planning the approach to the problem and in selecting those factors to be used in the evaluation of the results. Neither the geologist's concept of the deposit, nor the statistician's analysis of the data could stand alone.

One question not considered in this study is the economic basis for setting the confidence limits for the sample estimates. The 95 percent confidence limit was chosen on an intuitive basis as being acceptably high for decision purposes. In other instances the choice of the degree of confidence might be rationalized by balancing the cost of being in error against the additional cost of drilling for each degree of greater confidence.

In the development of a mining project from the start of geological exploration through commercial production, there are many complex and interrelated decisions that can be improved through the use of the methods of Operations Research. Thomas M. Ware [3] has predicted that Operations Research will be used in all phases of future mining activity. For an integrated company this will mean dynamic programming to minimize total costs, including those of mining, beneficiation, conversion, and transportation.

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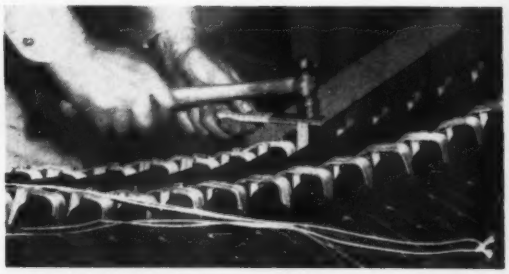
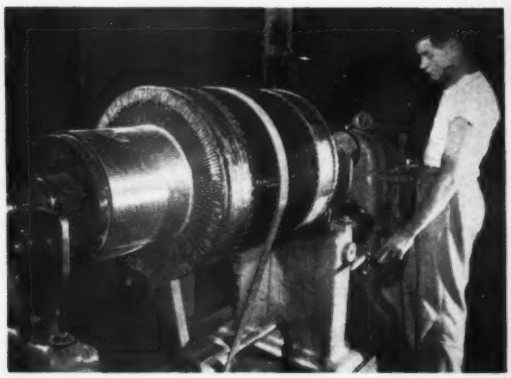


Blocking individual end turns of a stator from a large drag-line M. G. set. This is typical of the care and attention to detail which characterize National rewinding practices.



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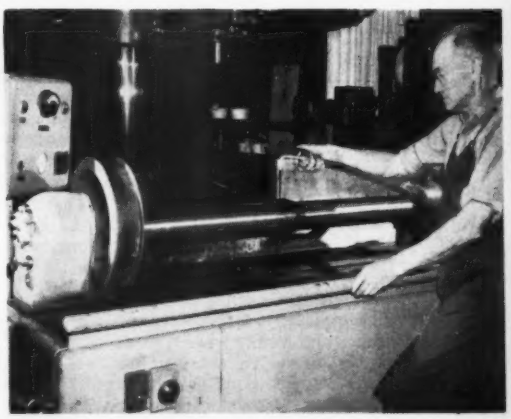

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In the majority of accidents either temporary roof supports were not used or the established timbering system was not complied with

Four Years of Roof Fall Accidents

Record Shows That Majority of Roof-Fall Fatalities Are Preventable

By GEORGE W. SALL

ACCIDENTS involving falls of roof, face, and rib each year account for more fatalities in the nation's underground coal mines than do all other types of accidents combined. The tragic part of this fact is that year after year only a small minority of these fatalities resulted from accidents that could not be foreseen or from unavoidable risks, according to the U. S. Bureau of Mines. This does not take into account the great number of nonfatal accidents or the "near misses."

Realizing the important part roof falls play in coal mine accidents, several industry agencies joined hands this year to sponsor the 1955 National Accident Prevention Campaign pointed toward the reduction of this type of accident. Unfortunately the campaign has not met with outstanding success. According to preliminary Bureau of Mines statistics for the first seven months of 1955, 64 percent of the fatal accidents underground in the nation's bituminous coal mines resulted from falls of roof or face. This is a slight increase over last year's figures—not a significant increase but certainly not the marked decrease that was hoped for at the start of the campaign.

Note: Statistics used in the foregoing article are from the following reports of the U. S. Bureau of Mines: HSS Nos. 415, 427, 436 and C.M.F. No. 289.

Accident Statistics Valuable

What, then, is the solution to the roof fall problem? It could be that a good part of the answer lies in other statistics collected by the Bureau of Mines. In February 1950 the Bureau began to investigate all fatalities in coal mines in the United States and Alaska. The studies are made by Federal coal mine inspectors and engineers who collect the data according to a prescribed form so that all information can be easily correlated. The accompanying table summarizes these data pertaining to fatalities that occurred from falls of roof, face, and rib for the years 1951, 1952, 1953 and 1954.

Unsupported Top Is Dangerous

A close study of the record shows several interesting things. About three-fourths of the roof fall fatalities for the last four years occurred within 25 ft of the working face and over three-fourths of these between the last permanent support and the face. In other words, well over half the fatalities from roof falls in the past four years occurred between the last permanent support and the coal face.

Just under half of the roof fall accidents at the face occurred where temporary supports were not used, and over half of them occurred in places where the established systematic timbering system was not complied with. In 1954, 34 percent of the roof-fall fatalities occurred in places where the adopted timbering system was being followed. This points up the need for constantly reevaluating timbering systems in the light of changing natural conditions.

There is nothing new or really startling about these figures. Every coal miner no doubt realizes, at least passively, that the face area is dangerous and that working under an unsupported roof is just asking for trouble. The value of systematic timbering and the faithful use of temporary supports before permanent supports are placed is also common knowledge. It appears, then, that efforts need to be redoubled to impress the man at the face with the dangers of unsupported or improperly supported roof. Rules and regulations are undoubtedly needed but what is needed more is some way to keep the miner continually conscious of this special danger of his occupation.

Some Ignore Roof-Fall Dangers

That familiarity tends to breed a certain callousness in the miner toward occupational hazards is borne out by other Bureau statistics. Average age of men killed in roof-fall accidents in the past four years is 43 and each man had an average of about 20 years of mining experience. It is often misleading to talk about "averages" but these figures certainly indicate that any accident prevention program should take into account the fact that a feeling of indifference towards mining hazards can be built up over the years by the individual.

Bolting Has Helped

Although 15 percent of the fatal roof fall accidents in 1954 occurred in places where roof bolts were used as a systematic method of support, in only one case did bolt failure cause the accident. And here the dangerous condition was observed but ignored. In the bulk of the other fatalities in this category, the roof fell inby the bolted area and temporary support was not installed. The Bureau reports that indications are that the fatality rate, based on tonnage, from roof falls is considerably less than in areas where conventional timber is used. The difference is on the order of 5½ to 1.

Mechanical mining is safer than hand mining when roof fall fatalities at the face are considered the figures show. Although just over half of these accidents happen in places where coal was loaded mechanically during the past four years, approximately three-fourths of the coal mined during the same period was mined mechanically.

Supervision Important

The size of mine also appears to have a significant correlation with roof fall accidents statistics. Records for the years 1952 and 1953 show that mines employing less than 25 men were substantially more dangerous than any other size group, based on the number of roof-fall fatalities per thousand men employed.

These data were not gathered for the year 1954 but the Bureau reports that in mines employing less than 15 men the fatality rate from roof-falls was 2.75 per million man-hours of exposure. In mines employing 15 or more men the roof-fall fatality rate was 0.54 per million man-hours.

It is apparent that an extra effort is going to have to be exerted to carry a safety crusade into the very small mines. They are often marginal producers, working only intermittently. Supervision is not all it should be some of the time and there is generally a lack of organized safety activity. Workers at these mines are particularly hard to reach and accident statistics show how great is the need for reaching them with safety programs.

Size Groups Men employed	Fatalities per thousand men employed 1952	1953
1-24	1.17	1.36
25-99	0.69	0.83
100-299	0.52	0.64
300-499	0.42	1.01
500 and over	0.55	0.77

TABLE I—A SUMMARY OF ROOF-FALL FATALITY DATA FOR THE LAST FOUR YEARS

	1951	1952	1953	1954
Percent of underground fatalities resulting from falls of roof, face, and rib	50	62	67	60
Percent of accidents attributed to human failure	80	87	88	93
Percent of fatalities resulting from accidents that could not be foreseen or from unavoidable risks	20	13	12	7
Percent of fatalities occurring at:				
a. Within 25 ft of face	71	64	71	78
b. Haulageways (not at face)	18	13	15	10
c. Other locations	11	23	14	12
Percent of face fatalities that occurred between the last permanent support and the coal face	81	85	83	76
Average distance (in ft) between the last permanent support and the coal face	14	12	13	12
Percent of total roof-fall fatalities that occurred in places where roof bolts were specified as a systematic method of support	4	5	9	15
Percent of face roof-fall fatalities occurring in places where coal was loaded mechanically	48	52	53	55
Average age of men killed in roof-fall accidents	42	43	44	43
Average mining experience (in years) of men killed in roof-fall accidents	18	20	22	21
Percent of face roof-fall fatalities occurring at faces where temporary supports were not used	57	41	30	44
Percent of face roof-fall fatalities occurring in places where the systematic timbering system was not complied with	Not compiled	62	60	56
Percent of face roof-fall fatalities occurring in places where there was no systematic timbering method	Not compiled	23	14	13
Percent of roof-fall fatalities by major occupations:				
a. Hand loader (car or conveyor)	30	36	26	26
b. Loading machine operator or helper	15	16	14	20
c. Mining machine operator or helper	14	13	15	14
e. Foreman	6	9	8	10

Hand loading, into car or conveyor, is the most dangerous single occupation underground

What Can Be Done?

The foregoing statistics lead up to one inevitable question—what can we do about it?

Laboratory research can improve the type of support and improve the tools for making roof tests. Safety drives can be conducted. However, roof supports are ineffective if they are not used properly and safety lessons are quickly forgotten. There are no short cuts. It will undoubtedly take a lot of plugging away at the safety theme to put across the point that the majority of roof-fall accidents can be avoided.

When the man at the face is educated to the point that he is constantly aware of the roof fall danger and treats all unsupported roof as bad roof, the accident rate from this number one killer of coal miners will come down fast.

The Estimation of Uranium-Vanadium Reserves on the Colorado Plateau

Methods of Determining Vanadium and Uranium May Spell Difference Between Success and Failure

By A. L. BUSH and H. K. STAGER
U. S. Geological Survey,
Grand Junction, Colo., and Manlo Park, Calif.

SINCE November 1947, the U. S. Geological Survey on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission has been actively engaged in diamond-drill exploration for uranium-vanadium ore deposits on the Colorado Plateau. Several million feet of bore hole have been drilled, and several hundred ore deposits have been found. Over a hundred geologists have been involved in the evaluation of these discoveries. Such evaluations, expressed in terms of reserves of uranium-canadium ore, are one of the major objectives of the Geological Survey's work on the Colorado Plateau. They are part of the basic data essential to an understanding of the ore deposits and fundamental to the planning of mill construction and production.

Uranium deposits considered in this paper are in the Salt Wash sandstone member of the Morrison formation. They range in size from a few tons to many thousands of tons; they range widely in content of uranium and vanadium, both within a single deposit, and from deposit to deposit. Most deposits are in the form of tabular masses that generally parallel the bedding of the enclosing sandstone. Some of these masses are equidimensional, or rudely oval; some are elongate and varyingly curved.

Other deposits, generally called "rolls," are lenticular, podlike, cigar shaped, or sinuous, with a long axis that lies parallel to the bedding; they cut across the bedding in a smooth curve along their short axes. Because of these variations in size, form, and also in grade, special problems are posed in estimating the reserves.

In order to compare the deposits found, it has been necessary to adopt some basic definitions and assumptions and to use certain standardized rules of classification and calculation. This is particularly necessary because the appraisals are made by many geologists of differing training, experience, and outlook.

The Geological Survey is concerned with three general classes of known reserves; measured, indicated, and inferred. The thickness and grade of ore are subject to erratic variations in short distances. Generally, there is not sufficient sample data to show, in great detail, these variations within a single ore deposit. As a result, the amount of ore that can be calculated with a small margin of error (and thus called "measured reserves") is very small. These reserves, therefore, are included with the indicated reserves. Indicated reserves presuppose a greater margin of error. However, a sufficient number of observation points, such as mine faces and drill holes, provide adequate geologic evidence for projecting the ore bodies between and beyond the observation points, and sufficient grade data from mine production and core samples allow reasonable grade estimates to be made. Inferred reserves are based on only a few points of observation, and perhaps only one to a deposit, and therefore result in a still greater margin of error. Quantitative estimates evolve mostly from broad knowledge of the geologic character of the deposits, based to a large extent on the size, grade, and habit of nearby better-known deposits.

The limits of error implied in these classes of reserves cannot be stated exactly. Measured reserves are defined by the Geological Survey as those whose limit of error is not more than 20 percent. Indicated reserves may amount to as much as twice or as little as half the calculated tonnage in any single reserve block. The margin of error of the total indicated tonnage for several blocks, however, is apt to be considerably smaller, perhaps not more than 25 percent of the calculated tonnage. For inferred reserves the margin of error in the tonnage figures is apt to be higher than for the indicated reserves. For both indicated and inferred reserves, the possible limit of error for grade estimates is probably somewhat smaller than for tonnage estimates.

One Man's Reserve

Certain minimum criteria must be met before a mass of mineralized rock can be considered a reserve. If these criteria are not clearly stated, one man's reserve may be another man's waste, and neither may be aware of the discrepancy. These criteria, which largely determine the minability of

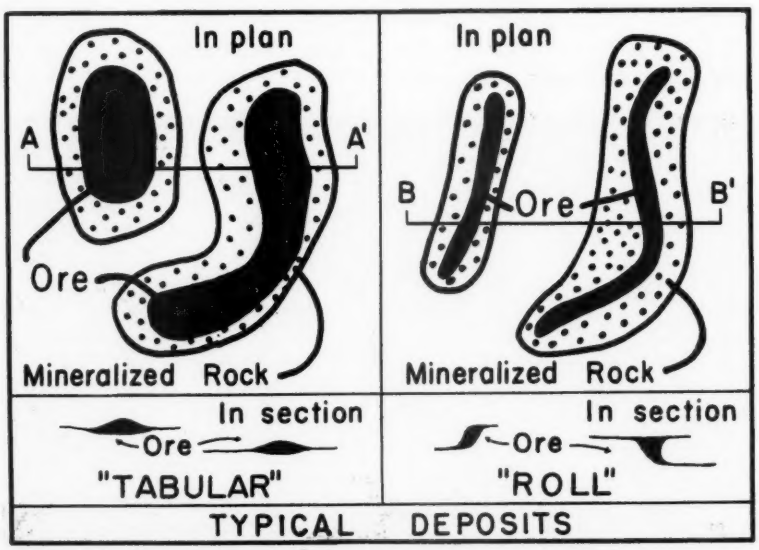


Fig. 1—Schematic diagram of typical carnotite deposits

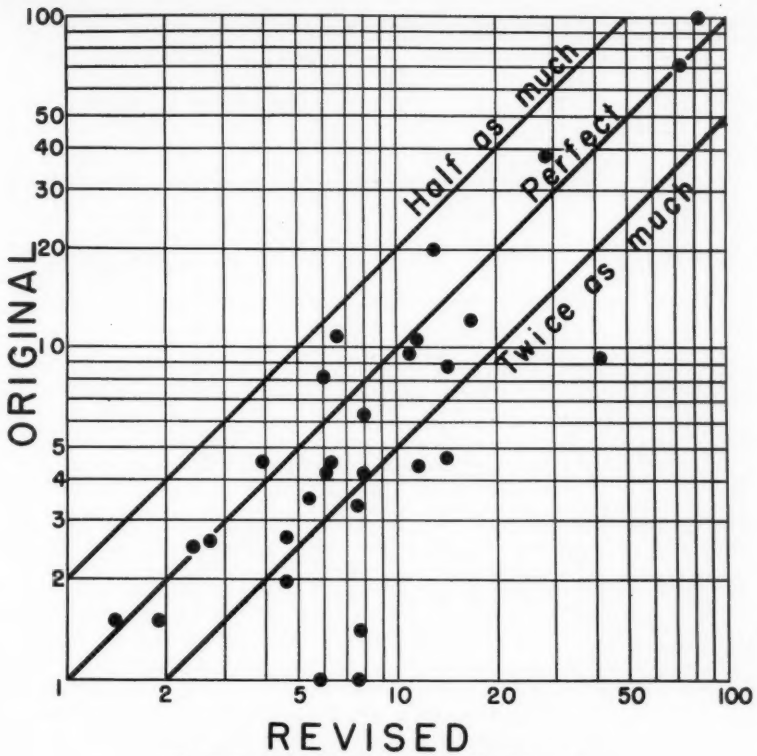


Fig. 2—Tonnage estimates for individual deposits

the deposit, include, of course, grade, volume, thickness, and depth below the surface. Twenty-five thousand-ton uranium ore deposits are attractive-sounding propositions, but it is one matter to mine such deposits if they are six ft thick and lie at a depth of 50 ft, and quite another matter if they are only six in. thick, and lie at a depth of 600 ft.

Criteria Used in Estimates

Mining practices vary from place to place in the region and from operator to operator. Generally, however, average-grade ore bodies will be mined to where they pinch to a layer about one ft thick. Reserves are calculated, therefore, with a thickness cutoff of one ft. Thinner, but high-grade layers can be mined in places; the total tonnage involved, however, is almost invariably small. Therefore, ore less than one ft thick is not classed as a reserve.

As both the uranium and vanadium in the deposits are of economic value, a bimetal grade cutoff must be used. In many cases the two metals are so erratically distributed in the deposits that a single sample, such as a drill-core assay, is not necessarily representative of either the grade or the uranium-vanadium ratio of the ore near the point sampled. Thus, the miner should drive, and will drive, to a drill hole with a high vanadium value, even if the uranium value is negligible. As the material around this sample point will be mined, it must be classed as a reserve, even though the sample shows only a one-metal value. In addition, under present price schedules, the vanadium content contributes a significant part of the total market value of the ore.

Two grade cutoffs are used. The higher one is 0.10 percent U_3O_8 or 1.0 percent V_2O_5, corresponding to the purchase cutoff for uranium and a general mill-acceptance cutoff for vanadium. Reserves are also figured on a lower cutoff, 0.05 percent U_3O_8 or 0.50 percent V_2O_5—on the possibility that conditions in the future might demand or permit the mills to accept lower grade ore.

It is necessary to describe briefly the density of sample points available from the Geological Survey's type of exploration. The Survey's level of operation is primarily exploration, rather than development drilling. First, the ground is evaluated with geologic mapping, to distinguish the favorable areas from the unfavorable, and the areas are then further delineated with drill holes spaced from 500 to 1500 ft apart. Second, the favorable ground is explored by drill holes spaced from 200 to 400 ft apart, in order to intersect each ore deposit of average area with at least one hole. Third, the size of the deposits is investigated, generally by four to six drill holes spaced 50 ft from the discovery hole, with succeeding drilling on 100-ft spacing, until the deposit is roughly outlined. With this density of drilling, the amount of ore that can be classed as "measured" is small indeed.

Very broadly speaking, most of the deposits are tabular masses with tapering edges. The basis for the calculation of the volume or tonnage of the deposits is the assumption that the deposit is a tabular mass, unless there is good geologic evidence that a "roll" has been penetrated. Mineralized units are correlated between adjacent drill holes, and the thickness of ore, above the two grade cutoffs mentioned above, is determined and averaged between drill holes, to be used as the average thickness of the reserve unit. The edge of the ore deposit is assumed to be halfway between a barren and a mineralized hole, and the rate of change of thickness is assumed to be uniform between sample points throughout the deposit. The one-foot isopach for the deposit is plotted, and the area within it, subject to projection limitations, is considered to be the area of the reserve block. Generally, indicated reserves are projected between drill holes 50 to 100 ft apart and 25 to 50 ft beyond drill holes, depending on

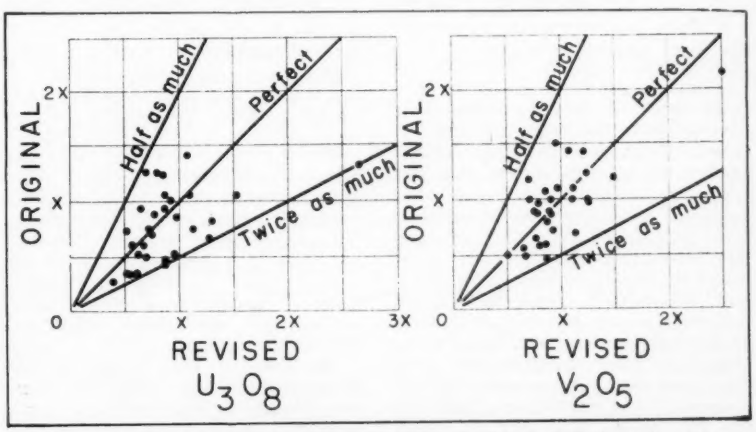


Fig. 3—Comparison of grade estimates (arbitrary units) for individual deposits

the geologic interpretations. If the projection is greater than these distances, or if there is only one penetration in the deposit, the ore is projected to the geologically assumed limits and classed as inferred. An interpretation of part or all of a deposit as a roll would bring it into this class as well. A factor of 14 cu ft per ton is used to convert volume to tonnage.

Grade Average Weighted

Generally, the average grade of an indicated reserve block is calculated by weighting assay grades by length of samples. If the deposit has been mined in part, the grade of ore produced is also considered. If there are only a few drill holes and the assay grades are much higher than the ore produced nearby, it is assumed that the drill penetrated abnormally high-grade parts of the body, and an estimated grade is given. In an inferred reserve block there are far fewer sample points by definition; therefore more weight is given to production from nearby mines.

Strict grade cutoffs are used in calculating reserves one ft or more thick. Material from a class with a lower cutoff grade is excluded from material of a class with a higher cutoff grade, even though the weighted average grade of the whole is above the cutoff grade of the higher class. There is one exception. The barren, or low-grade material must be less than one ft thick; it must lie between two ore-grade layers; the three layers must total more than one ft thick; and the over-all grade must be above the grade cutoff. If these conditions are met, the material is included in the reserve. Some of the waste might be picked out by hand, but most of it would go to the mill with the ore. If the waste is greater than one ft thick it would probably be blasted separately from the ore; thus, ore layers more than one ft apart are calculated as separate ore bodies.

The Results

A little over two years ago, a reappraisal was made of the deposits that had been found. The deposits considered ranged from about 1000 short tons to more than 50,000 short tons of indicated and inferred reserves. In all cases there was a large amount of information on size and grade that was additional to that available when the reserve estimate was made originally. This information included production data, additional drilling, accessible mine faces, etc. Production since the original reserve estimate had to be at least 25 percent of the original reserve in order to give representative and significant data. A reappraisal of the reserves in the ground was made for the 30 deposits that met the above conditions. These deposits are representative of those being found by our exploration. Production was added to each new reserve figure, and the total compared with the original reserve figures served as a measure of the accuracy of the original reserve.

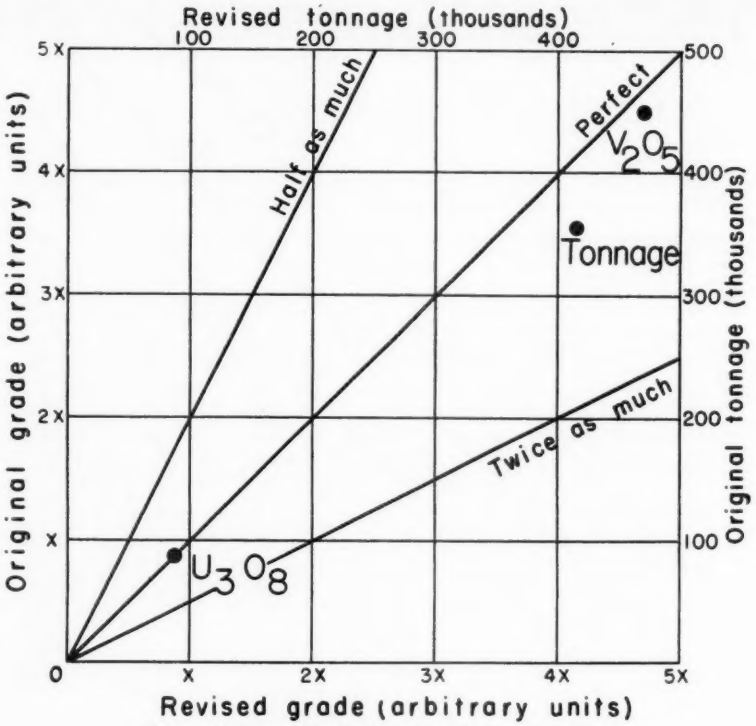


Fig. 4—Accuracy of estimates for all deposits studied

All the deposits studied contain over half the tonnage of reserves originally estimated (fig. 2). About one-quarter of the deposits contain more than twice the original tonnage estimate. This agrees quite well with the general definition that the margin of error in tons of indicated reserves would be from one-half to two times the original estimate. It must be reemphasized that indicated and not measured reserves are dealt with here.

The limits of error for both U_3O_8 and V_2O_5 grade estimates were smaller than for the tonnage (fig 3). V_2O_5 was estimated a bit more accurately than U_3O_8.

As the deposits are totaled into groups (such as claim groups), errors cancel each other out, and the limits of error for tonnage and grade become considerably smaller. The same is true as these groups are summarized into district totals and grades, for then the error becomes still smaller. Finally, summation of all 30 deposits give the following results. About 15 percent more ore, in terms of tonnage, was found than was originally estimated. The U_3O_8 grade is the same as that originally estimated, and the V_2O_5 grade only differs very slightly in that about two pounds more V_2O_5 *per ton* was produced than was originally estimated.

What can be done to make the original estimates more accurate for individual deposits? Within the scope of diamond-drill exploration the Geological Survey is doing, only one remedy exists—increase the density of drililng. However, accurate reserve figures on individual deposits are primarily the interest of the operator, while the Geological Survey's interest is in the summation of the reserves of many deposits. To this end, the present exploration and reserve estimation methods appear to be satisfactory.

Increased drilling density would make original ore estimates more accurate

Operators Corner

Wet Down Limestone Automatically

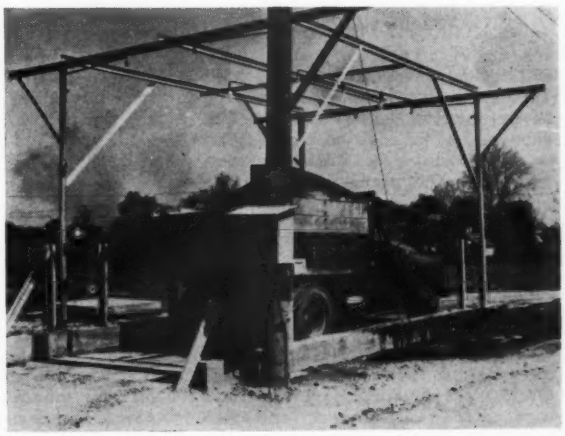
AN electronically-operated spray system wets down truckloads of dusty limestone at the M. J. Grove Lime Co., Frederick, Md.

Truck drivers leaving the firm's crushed limestone plant drive under a steel spraying rack supporting eight water sprinklers. An electric eye at the rack entrance starts a pump motor when the truck breaks the path of the electronic beam.

Windshield wipers going, the truck continues through the rack, leaving the plant with the limestone wet down and the truck rinsed. Another electric beam at the exit end of the rack stops the pump motor when the truck passes completely through.

Grove Co. engineer Col. Robert Barrick designed the overhead spraying apparatus to comply with state laws requiring truck-carried limestone screenings to be wet down during the summer months. The automatic operation of the system saves the time and inconvenience of having the truck driver leave the vehicle.

Water supply for the spray system is provided by a two hp Deming shallow well jet pump located in an eight-

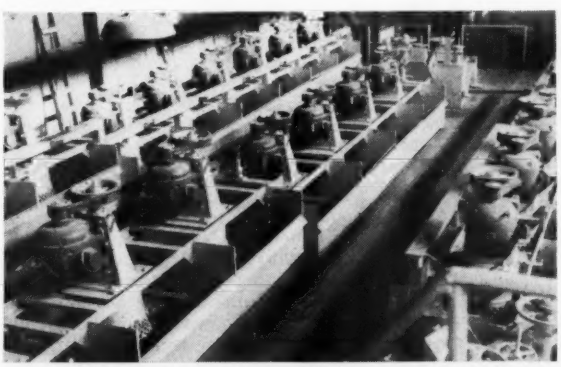


ft pit over a well near the sprayer. Operating at about 30 psi, the jet pump delivers 15 gpm from the 20 ft high sprays.

V-Belt Storage

WHETHER it's a bottle of vitamin pills for human energy or a package of V-belts for machine power, the same storage procedure applies:

"Keep in a cool, dry place."



To get best results out of your V-belts, treat them well in storage

If V-belts get wet from water seepage or from a damp floor, they may shrink or become otherwise damaged, warn engineers of Dayton Rubber Co. Placing them near a hot radiator or in high-temperature storage rooms also may damage their efficiency.

A little care in storing can save a lot of time, trouble and money later on.

It's also a good practice to keep enough belts on hand at all times to take care of any replacement problems which might suddenly arise. If one belt should fail in a multiple drive, the entire drive should be provided with a new matched set.

Simply putting on one new belt is not enough. A belt which hasn't been worn is shorter than the worn ones and thus would have to pull most of the load. This would cut down on the drive efficiency and greatly shorten the new belt's life.

Belt replacement costs are usually small, even for a full set. But thousands of dollars can be lost if a machine, workers and production stop while replacement belts are sent for, delivered and installed. Having extra belts on hand will eliminate most of this waste time.

Wheels of GOVERNMENT

As Viewed by HARRY L. MOFFETT of the American Mining Congress

WITH Congress in adjournment, the Washington spotlight is focused on the Government Departments and Bureaus which, in addition to performing their regular activities, are now engaged in the preparation of their budgets for next year and the drafting of legislative proposals to be submitted at the next session of the 84th Congress.

Biggest economic news emanating from the Capital in the past few weeks was the announcement by Treasury Secretary Humphrey and Budget Director Hughes that a balanced Federal budget is in prospect for this fiscal year and that cuts in both individual and corporate tax rates may be in the offing. The Administration officials declared that booming business and Government economies may well wipe out what appears to be a prospective budget deficit of $1.7 billion.

Humphrey has stated that if the Government departments and agencies can prune their outlays by about three percent by the end of the fiscal year, the budget can be in balance. He said a further slash would justify lower tax rates. He told a news conference that he thought taxes are too high for the best interests of the country. Following this announcement a drive was instituted throughout the Government to effect economies aimed at achieving the balanced budget.

Next year being a presidential election year, it is highly probable that both the Administration and the Democratic Congress will lean heavily towards adoption of reduced taxes. Top ranking members of the Senate Finance Committee have expressed the view that lower tax rates should be voted in 1956. Both Senators George (Dem., Ga.) and Millikin (Rep., Colo.) have indicated that they will favor tax reductions even if Government spending and income are not completely in balance.

Mineral Purchase Programs

One of the last acts of President Eisenhower before leaving for his Denver vacation was the vetoing of the Engle bill (H. R. 6373) which would have doubled the domestic mineral purchasing programs for tungsten, manganese, chromite, mica, asbestos, beryl and columbium-tantalum ores.

In stamping his disapproval on the measure, the President said that it would require the Government to purchase far greater quantities of these minerals than are needed for the national defense. He also said that the bill would have applied only to a small segment of the mining industry and would not reach the "fundamentals of the problem."

Mr. Eisenhower declared that he favored the development of a long-range minerals program for the country to assure an adequate mobilization base and to maintain a sound minerals economy, but pointed out that the Office of Minerals Mobilization has been established in the Department of Interior to outline such a program.

The President took the position that the minerals industry will be better served by "proceeding with the careful development of a long-range minerals program than by approving a stop-gap measure extending substantial Government aid to only a segment of the industry." He said that while the more permanent programs are being developed the existing purchase programs will continue under the regulations presently in effect.

The Office of Minerals Mobilization has not as yet issued any recommendations for long-range programs for the various mineral industries, and it is likely that the next session of Congress will see determined efforts to establish some programs for minerals needed for national defense. Whether the Congress will endeavor to wrap these into one measure or will seek adoption of programs on a mineral-by-mineral basis remains to be seen.

Mining Law Administration

Long-awaited regulations governing the administration of Public Law 585, which resolved conflicts between the mining laws and the Mineral Leasing Act, have been issued by the Bureau of Land Management. The regulations, contained in Circular 1920, provide for the establishment of multiple mineral development of the same tracts by permitting Mineral Leasing Act filings, such as those for oil and gas, on prior claims located under the General Mining Laws, and vice versa. They also set forth procedures under which mineral leasing applicants are authorized to publish notice requiring mining claimants to reveal any interests which may be adverse to lessees, and for public hearings resulting from such notices. The regulations make it clear that under the new law valid mining locations may be made for fissionable source materials.

These regulations were prepared by BLM following conferences with representatives of the mining and oil and gas industries. Copies may be obtained from the land offices of the Bureau.

BLM has also issued regulations designed to facilitate the handling of applications for prospecting permits and mineral leases on "acquired lands" —these being lands acquired by the Federal Government through purchase, condemnation, exchange or donation, as distinct from the Public Domain. These regulations include acreage limitations and a $10 filing fee. A single permittee or lessee cannot hold more than 10,240 acres in

Washington Highlights

BALANCED BUDGET: Heralds tax cuts

MINERALS PURCHASES: Stopgap programs vetoed

MINING LAW: Regulations issued.

OIL IMPORTS: ODM studying

COAL MINIMUM WAGES: Proposed by Labor Department

COAL WAGE AGREEMENT: New one-year contract signed

TARIFF NEGOTIATIONS: Announced by White House

any one State for the same mineral under a prospecting permit and lease combined, and a single prospecting permit is limited to 2560 acres.

Meanwhile, both the Bureau of Land Management and the Forest Service are working on regulations to govern the administration of the recently-approved law providing for prevention of abuses of the mining laws and for multiple use of the surface of mining claims hereafter located. No announcement has been made as to when such regulations will be issued, but the Departments are pushing hard to develop "ground rules" that can be made known to industry in the near future.

Also in the public lands field, the Department of Interior will open 46,440 acres of lands in the Pumpkin Buttes area of Wyoming to mineral leasing and mining locations, effective November 17.

Oil Import Data Sought

ODM Director Arthur S. Flemming has called upon oil importing companies for data as to their imports of crude oil, refined products and residual oil for the first seven months of this year, and has asked for an estimate of their planned imports for the next eleven months.

Flemming stated that this information is desired in view of his responsibilities under the new Trade Agreements Act, which requires him to inform the President if any article is being imported in such quantities as to threaten national security. He said he had received figures indicating that crude and residual oil imports of some companies have exceeded and will continue to exceed significantly the respective proportions that such imports bore to the production of domestic crude in 1954. It will be recalled that the Cabinet Committee on Energy Resources and Fuels Policy had recommended that when such a situation arose, the Government should step in to limit the imports and bring them back into proper balance with domestic crude production.

The ODM Director has requested the oil importing companies for a month-by-month comparison of imports in 1955 through July 31 with corresponding months in 1954, and for their plans for oil imports for the remainder of this year and through the first six months of 1956. His action followed recent requests from 27 Senators that the Government take action under the Trade Agreements Act to stem the flow of oil imports.

Walsh-Healey Coal Wage Proposal

A proposal to establish minimum wage rates for the bituminous coal industry has been announced by Labor Secretary James Mitchell. Rates ranging from $1.40 to $2.346 an hour as the prevailing hourly wage minimums in some 22 bituminous coal producing districts would be set by the Department under the Secretary's proposal, which comes as a result of public hearings held last February. The action was taken under provisions of the Walsh-Healey Public Contracts Act which permits the Secretary to establish "prevailing minimums" and to require their payment by Government contractors whose contracts are in excess of $10,000.

The Secretary published the proposal August 6 and gave the industry 30 days in which to file exceptions to the wage minimums. In view of the protests developed from some segments of the coal industry at the public hearings last February, it is anticipated that objections will be filed.

Mitchell said that the 22 coal districts are those historically recognized by the coal industry as accepted separate economic areas. They are the same as set up in the Guffey Coal Act.

In announcing the proposed rates, the Department said that the most significant rate is that of $2.245 an hour, which would apply to 9 districts accounting for about four-fifths of the country's coal output. These districts embrace Pennsylvania, Maryland, West Virginia, Virginia, eastern Kentucky, northern Tennessee, Ohio and Illinois.

The Labor Department said that during 1954 bituminous coal purchases by the Government approximated 13,000,000 tons, with three-fourths of this quantity being bought by the Tennessee Valley Authority.

The proposed wage rates, the Department stated, are minimum hourly rates to be paid to day workers in the bituminous industry engaged in Government contract work. In the case of tonnage workers, the minimum wage obligations will be considered met if a majority of the tonnage workers in the mine with a Government contract earn the minimum rate applicable to their district, and the average earnings of the tonnage workers as a group are in excess of the minimum. The proposal does not apply to engineering crews, weighmen, supply clerks and other auxiliary workers traditionally regarded as part of management.

In the event the minimum wage rates are approved, they will not apply to existing Government contracts but only to those entered into after issuance of the final wage order.

Coal Wage Pact

Labor peace in the bituminous coal fields seems assured for another year. Bituminous coal operators have agreed to a new one-year wage pact under which the miners will get a wage increase of $2 per day, time and a half for Saturday work, double time for Sunday work, and a 12-day vacation with $140 in vacation pay instead of the present 10 days with $100.

The contract is to run to September 1, 1956 and is open-end, with a 60-day notice required to be served by either party prior to termination of the pact. The earliest such a notice could be served is August 31, 1956.

Of the 25-cent-an-hour increase, a 15-cent-an-hour boost went into effect on September 1 while the additional 10 cents an hour will become effective April 1, 1956. The new basic daily wage for miners will then be $20.25.

The new contract was first negotiated between John L. Lewis of the UMWA and Harry M. Moses of the Bituminous Coal Operators Association, who had conducted private negotiations on it since April. Southern and western operators later agreed to the contract.

In announcing the new agreement, Lewis termed it "sane and in the public interest."

As a result of the pay raise, bituminous coal prices were hiked some 30 to 40 cents a ton at the mines, pushing the average price at the mines over the $5 per ton mark for the first time this century. It is expected that another price boost will be made when the further pay raise is put into effect next spring.

Having concluded the bituminous agreement, it is anticipated that Lewis will seek a new pact along similar lines with anthracite operators.

Tariff Cuts on Way

The Administration has announced that consultations are under way with other countries to lay the groundwork for tariff negotiations next year. Some Government officials have indicated that the United States will offer to cut import duties 15 percent at forthcoming discussions of the General Agreement on Tariffs and Trade (GATT) in Geneva next January.

Such reductions would represent the maximum permitted under the new Trade Agreements Act, which authorizes the President to lower tariffs on individual items by no more than 5 percent a year during each of the next three years. In offering the 15 percent reduction, the United States would thus have to make it clear that the reductions are to go into effect gradually during the three-year period.

Prior to the negotiations, a list of products subject to possible tariff concessions will have to be made public and public hearings conducted at which affected domestic industries may testify.

No announcement has been made as to the countries with which negotiations will be carried on but it is expected that some 25 of the 34 member countries of GATT will participate in the Geneva gathering next year.

AMC Personal

Ralph E. Jamison, Jr., vice-president of Pittsburgh Consolidation Coal Co. and formerly vice-president of the Jamison Coal & Coke Co., has severed connections with the coal industry to become associated with a Pittsburgh stock brokerage firm of Moore, Leonard & Lynch. Jamison joined Pittsburgh Consolidation last fall when that company acquired the properties of Jamison Coal & Coke Co.

William B. Porterfield, Jr., has joined National Potash Co. as vice-president and sales manager.

Porterfield resigned as assistant sales manager of United States Potash Co. to become associated with the newly-formed company, which is jointly owned by Freeport Sulphur Co. and Pittsburgh Consolidation Coal Co. National Potash is constructing a mine and plant to produce potash from a substantial deposit near Carlsbad, N. M.

Byron E. Grant has been named assistant general manager of the Braden Copper Co., according to an announcement by C. D. Michaelson, Braden vice-president. The copper company, Chilean division of the Kennecott Copper Corp., maintains operations in the Sewell-Rancagua area of Chile.

In 1936 Grant was employed by the U. S. Smelting Refining and Mining Co. as geologist in the Bingham, Utah, mining area. During an 18-year affiliation with this firm, he rose to the position of assistant to the vice-president and general manager of Western Operations. He resigned this post late in 1954 to enter private practice as a mining consultant in Salt Lake City.

Three vice-presidential appointments at Battelle Memorial Institute, Columbus, Ohio, were recently announced by Dr. Clyde Williams, Institute president and director.

Named were Dr. **B. D. Thomas, David C. Minton, Jr.,** and **John S. Crout.** All three have long been associate directors of the research organization, and along with Dr. Williams, comprise the key policy-making and executive team in Battelle management.

Gregory S. DeVine has joined Southern Coal Co., Inc., Chicago, as a vice-president. He recently resigned his position as vice-president and director of Truax-Traer Coal Co. DeVine's duties with Southern will be in connection with the general sales and administrative work of the company.

Royal S. Foote has resigned as head of the Geophysical Exploration Branch, Raw Materials Division, United States Atomic Energy Commission, to form Resources Development Corp. The new company, which will have offices in New York at 501 Madison Ave., and in Denver, will function as uranium and mining consultants and exploration specialists, and will offer advisory services in radiation instrument development.

James L. Hamilton, vice-president in charge of operations, Island Creek Coal Co., has been listed as director of the company to fill the vacancy left by the death of J. E. Davis.

James I. Craig, formerly plant chief of the Austinville, Va., mine of The New Jersey Zinc Co., has been made superintendent of the Hanover, N. M., operation.

Craig started with the company in 1935 as a mining engineer at Austinville and progressed through the organization to become plant chief in 1950.

Carroll F. Hardy, chief engineer of Appalachian Coals, Inc., Cincinnati, Ohio, became Director of Sales Engineering for National Coal Association September 1.

Hardy heads the new Department of Sales Engineering which will supplant some of the work previously performed by NCA's Coal Heating Service. The department will handle NCA's program to promote the marketing of coal and its efficient utilization. Hardy has been associated with the coal industry some 18 years, practically all of this time with Appalachian Coals, Inc.

Hollis M. Dole has been appointed director of the Oregon Department of Geology and Mineral Industries. Dole has been with the Department since 1946. In August 1954, he was made an assistant director and in November of the same year, at the retirement of **F. W. Libbey,** was appointed acting director.

George T. Gillison has been appointed chief mine inspector of the Gary District of the United States Steel Corp.

John Cameron Fox, who has been editor of MINING CONGRESS JOURNAL for the past five years, has resigned from that post to accept a position as assistant manager of mines for American Metal Co., Ltd. He will take over his new duties in mid-October and will be headquartered in New York.

Fox will be succeeded as editor by Robert W. Van Evera, formerly with Calumet & Hecla, Inc.

Pocahontas Fuel Co. has announced the appointment of **J. W. Pero** as director of safety and mine inspection and **William Maratta** as director of plans and development.

Pero has been with Pocahontas Fuel since 1943 as safety engineer and then as production manager. Maratta has been with the coal company since 1953 as administrative assistant to the president. The position of director of plans development is a newly established position with Pocahontas Fuel Co.

Sim S. Clarke, general superintendent of the Tri-State Mines Div., Eagle-Picher Co. since 1948 has retired to take up consulting work. His long career includes positions as mining engineer and division superintendent for St. Joseph Lead Co., superintendent of mines, Commerce Mining & Royalty Co. at Miami, Okla., and Eagle - Picher Co. at Cardin, Okla. In all of these he was closely identified with mine mechanization and he plans to specialize in this field. He can be reached at 429 Cherokee Ave., Baxter Springs, Kans.

Journal Gets New Editors

Robt. W. Van Evera

Geo. W. Sall

ROBERT W. VAN EVERA will be the new editor of Mining Congress Journal, succeeding John C. Fox. Formerly with Calumet & Hecla, Inc., Van Evera has had wide experience in metal and coal mining. He is a graduate of the Michigan College of Mining and Technology and attended Harvard Business School in 1940 and 1941 until called to active duty as an ensign in the U. S. Naval Reserve. He served as active Supply Corps officer in the Pacific theater; with the Sea Bees in Newfoundland and at the Navy Yard in Washington, D. C. He was released to inactive duty as a Lieutenant Commander in 1945.

His mining experience dates back to the track gang at Utah Copper and since then includes work with Butler Brothers, as engineer in the district office on the Mesabi Range and in coal exploration in western Kentucky. When Butler Brothers merged with M. A. Hanna Co., Van Evera stayed on as engineer, pit foreman and engineering office supervisor until 1951. He then spent a period as chief engineer for Reynolds Jamaica Mines, Ltd., in the British West Indies, leaving that post to go with Calumet & Hecla, Inc. in Michigan to serve as technical assistant to the mine manager and as supervisor of industrial engineering. He is also familiar with metal mining operations at Butte; in Grass Valley; the Coeur d'Alene district and the Black Hills, as well as with coal mining in Wyoming and Utah. His Canadian travels include visits to Sudbury, Kirkland Lake, Timmons and Noranda.

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GEORGE W. SALL, assistant editor of Mining Congress Journal, will fill the newly created post of managing editor. In addition his activities and responsibilities in the work of the AMC Coal Division have been increased. When Sall joined the JOURNAL, four years ago, he brought a practical knowledge of production and engineering gained in the mines of Pennsylvania and West Virginia. After graduation from Ohio State University, he was field engineer for U.S. Coal & Coke Co., miner, draftsman, and engineer with Pittsburgh Coal Co. He saw service then during World War II in the U.S. and European theaters as demolition specialist with an engineer combat battalion.

In his more than four years with Mining Congress Journal Sall has visited and reported on many deep and strip mining operations and gained a deep insight into the problems entailed in the mining and preparation of coal. His growth, both in knowledge of the industry and in editorial know-how and writing ability, more than fits him for his new duties as managing editor.

Carroll A. Garner resigned August 31 as vice-president in charge of operations of the Jeddo-Highland Coal Co. He was succeeded by **Wilmot C. Jones**, formerly vice-president and general superintendent.

Garner has long been prominently identified with the anthracite industry. He entered the employment of Lehigh Valley Coal Co., as a member of the Engineer Corps in 1913 and was named division engineer in 1916. In 1921 he left Lehigh Valley to become assistant general manager of Jeddo-Highland. He was elected vice-president of the company in 1937. Since 1938 he has served as a member of the Industry's Wage Negotiating Committee and the Committee of Twelve, set up under the Joint Wage Agreement with the United Mine Workers of America. He was active in the American Mining Congress and served as one of its directors until his retirement from Jeddo-Highland.

Harry B. Lake, senior partner of Ladenburg, Thalmann & Co., has been elected to the board of directors of the American Zinc, Lead & Smelting Co.

Frank E. Cash retires October 8 afted 33 years in the mining and safety divisions of the United States Bureau of Mines.

While serving the mining, petroleum and allied industries as mining and supervising engineer, he was located at Pittsburgh, Pa., 1923-25; Birmingham, Ala., 1925-41; Duluth, Minn., 1941-49; College Park, Md., 1949-50; and Washington, D. C. 1950-55.

At the annual meeting of the Lake Superior Iron Ore Association in Duluth, Minn. July 14, the following officers and directors were elected for one year: **Franklin G. Pardee**, president; **A. C. Brown**, vice-president; **H. C. Jackson**, vice-president; **Hugo Johnson**, vice-president; **Arthur B. Rathbone**, treasurer, and Mrs. **Hazel M. Ronk**, secretary.

Appointment of **L. J. Lowell** as sales manager and **R. S. Bailey** as assistant sales manager of the Coal Division of Eastern Gas and Fuel Associates has been announced.

They will be in charge of commercial coal sales for Eastern Gas in the United States and Canada, except in the New England states, which will continue to be handled by New England Coal and Coke Co., an Eastern Gas subsidiary.

Paul W. Allen, has joined the staff of Cyprus Mines Corp. in Los Angeles. Allen will be responsible for the Copper Queen and Old Dick Mines near Bagdad, Ariz. He has also been elected vice-president and general manager of Pima Mining Co. near Tucson, Ariz.

Wm. J. Waylett, formerly chief. Technical Services Branch, Division of Raw Materials, A. E. C., Washington, D. C., relinquished that post to take on the responsibilities of chief, Minerals Resources Division, U. S. Operations Mission to Israel, International Cooperation Administration. He will be headquartered in Tel Aviv, Israel. Waylett took over duties at his new post on August 15.

Fred L. Shanklin has been appointed vice-president and general manager of the Ore Division of Union Carbide and Carbon Corp.

Robert W. Lefferts has been elected secretary-treasurer of Penn-Dixie Cement Corp. to succeed **George Kilian,** retiring as secretary-treasurer of the company.

Lefferts, who has been controller of Penn-Dixie since 1950, was with Price, Waterhouse & Co. prior to that time.

Kilian has been associated with the

R. W. Lefferts

George Kilian

cement industry for more than 50 years. He was secretary-treasurer of Dixie Portland Cement Co. in Chattanooga, Tenn., from 1908 until that company formed part of the merger by which Penn-Dixie Cement Corp. was created in 1926. He has been secretary-treasurer of Penn-Dixie since its inception.

Meanwhile **M. L. Silcox** has been appointed general operating manager of Penn-Dixie. He will be in charge of all operating and engineering activities of the company. He succeeds **E. P. Newhard,** vice-president and operating manager, who retired September 1.

— *Obituaries* —

William A. Ogg, Sr., 71, died at Natick, Mass., July 3. He was a retired official of the Island Creek Coal Co. and the American Zinc, Lead & Smelting Co.

Mr. Ogg joined Island Creek in Boston in 1907 after coming to this country from Aberdeen, Scotland. He was a director of the company from 1915 to 1917 at which time he resigned to become president of American Zinc, Lead & Smelting Co. In 1937 he returned to Island Creek Coal Co. in Huntington, W. Va., as manager of research, a position he held until his retirement in 1949.

William H. Price, 65, retired head of the mining accounting department at Pickands Mather & Co., died in Twinsburg, Ohio, July 14. Mr. Price retired January 1. He started with Pickands Mather 49 years ago as an office boy.

Michael J. Scollard, 83, secretary of the Indiana Coal Producers Association from 1918 until his retirement 10 years ago, died at his home in Terre Haute, Ind., July 5. Mr. Scollard took active part in industrial wage negotiations in Indiana. Prior to becoming secretary of the Indiana Coal Producers Association he had served as Indiana State Mine Inspector under three administrations.

Lewis P. Larsen, 79, president of Pend Oreille Mines & Metals Co., died July 14. Mr. Larsen was one of the men credited with opening the Metaline zinc-lead mining district of Northeast Washington. A native of Denmark, he came to the United States in 1895. He founded and laid out the town of Metaline Falls, Wash. in 1910.

Morris F. LaCroix, 67, president of the Copper Range Co. and senior partner of Paine, Webber, Jackson & Curtis, members of the New York Stock Exchange, died July 28.

Mr. LaCroix received a Masters Degree in mining engineering at the Harvard Graduate School of Applied Science in 1911. Last year he was honored by the Michigan College of Mining & Technology with the degree of Doctor of Engineering in recognition of his work in developing low-grade copper ores in the Upper Michigan Peninsula.

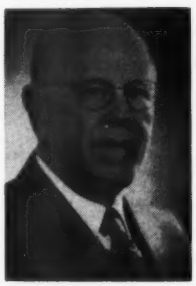
James A. McQuail, 74, prominent Pocahontas coal operator died August 23.

A native of Pottsville, Pa., Mr. McQuail went to the Pocahontas coal fields in 1902 to become associated with his father and a brother in the operation of the Turkey Gap Coal Co. In 1953 the McQuails sold their coal interests to the Crozer Coal & Land Co. At the time of his retirement in 1953, Mr McQuail was the oldest active operator of the original coal operators who developed the Pocahontas coal fields.

Marcel Dupont, consulting engineer for Union Miniere Du Haut-Katanga and Vice-president of Indussa Corp., died suddenly July 24.

Edwin Letts Oliver, 77, a noted mining engineer and Founder-Chairman of Dorr-Oliver Incorporated, died suddenly at Lake Tahoe, Calif., August 28.

Mr. Oliver is best known for his work in the field of continuous filtration, but his career in metallurgy was a long and distinguished one. He was graduated from the University of California, College of Mines, in 1900. The Oliver Continuous Filter was developed in 1907 as a result of his work in trying to improve gold recoveries and reduce tailings losses at the North Star Mines in Grass Valley. Mr. Oliver was also one of the founders of the famous Idaho-Maryland Mine, for many years one of the largest of U. S. gold producers. In December, 1954, Oliver United Filters, Inc., with Mr. Oliver as president, merged with The Dorr Co. to form Dorr-Oliver Incorporated.



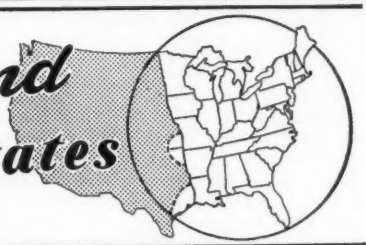
Richard Samuel Reynolds, Sr., 73, chairman of the board of the country's second largest primary aluminum producer, Reynolds Metals Co., died at his home in Richmond, Va., on July 29.

Arnold Gerstell, 77, widely known bituminous coal operator, died July 20 at Ardmore, Pa.

Mr. Gerstell became active in the coal industry in West Virginia at the turn of the century. He and his younger brother established the firm of Gerstell & Co. at Grafton in 1902. Then after a year in charge of the Davis Colliery Co.'s office in Detroit, he came to Philadelphia in 1904 as general sales manager for the distributing firm of Kersey Heilner & Son. Mr. Gerstell also took an active part in the organization of the Allburn Coal Co. in the Puritan Coal Corp., producing companies in the Southern fields. He severed most of these long-time connections with the coal industry in 1941.

NEWS and VIEWS

Eastern and Central states



Cement Plant Safety

The Duluth plant of the Universal Atlas Cement Co. held a picnic for its employes and their families July 23 to celebrate the rededication of a trophy awarded to the plant for outstanding safety achievement in 1954. The Duluth cement plant which first won the Portland Cement Association's safety trophy in 1925 has had eleven rededications since that time. The award is made for working a calendar year without having a disabling injury. Currently, the 325 men employed in the plant have gone more than two years without a lost-time accident.

Build Coke Ovens at Lorain

A contract to build a battery of 59 chemical-recovery coke ovens and auxiliary equipment at the Lorain, Ohio works of the National Tube Division of U. S. Steel Corp. has been awarded Koppers Co., Inc., it was announced recently by H. A. Denny, vice-president and assistant general manager of Koppers Engineering and Construction Division.

This is the eighth contract to be awarded by National Tube to Koppers to build batteries at the Lorain site. Four batteries of 52 ovens each, built some time ago, are still in operation as well as two 59-coke oven batteries. In addition Koppers is completing construction of a 59-oven battery begun about a year ago.

When the new gun flue type coke oven battery is completed it will increase the coal carbonizing capacity of the Lorain works approximately 1088 tpd.

Auxiliary equipment to be built includes a quenching station and primary cooler.

Engineering work on the new battery already has begun.

Westmoreland Opens Mine

Westmoreland Coal Co. has announced the opening of a new mine in West Virginia at an initial cost of $2,500,000. The highly mechanized operation is expected to have a reserve of 100 years in the seven-ft seam underlying Logan and Boone Counties. The property is reported to contain 190,000,000 tons of recoverable bituminous. The new slope-mine—Hampton No. 3—adjoins another Westmoreland operation which has been in operation since 1950.

50 Years of Service

Its fifty years of research, publication, and public service on the coal and other mineral resources of Illinois will be commemorated by friends and "alumni" of the Illinois State Geological Survey, State industrial leaders, and delegates of universities and colleges, on October 11, 1955, in Urbana-Champaign.

Thurlow G. Essington, chief counsel of the Illinois Coal Operators' Association, Chicago, will preside at the forenoon session. Morris M. Leighton, chief emeritus of the Survey, who had a carreer of 31 years as chief, will address the gathering on "The Survey's response to the economic pattern of the past fifty years."

J. R. Van Pelt, president of the Montana School of Mines and director of the Montana Bureau of Mines and Geology, will be the principal speaker at the mineral industries luncheon to be held in the Illini Union. An interesting afternoon symposium has been planned in which industrial leaders will participate.

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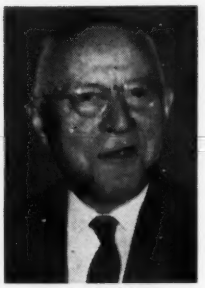
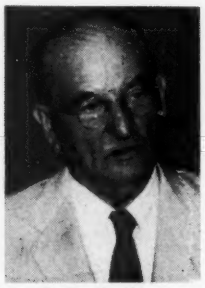


A. C. Fieldner



E. D. Gardner

J. D. Secrest

J. H. Hedges

On August 23, members of the U. S. Bureau of Mines and a number of their long-time friends joined together in honoring Florence E. Harris, Arno C. Fieldner, E. D. Gardner, J. D. Secrest and J. H. Hedges on the occasion of their retirement from active service with the Bureau

Felix E. Wormser, assistant secretary, Department of the Interior, acted as toastmaster for the evening and John J. Forbes, director of the Bureau of Mines, introduced the honorees. Miss Harris was awarded the Meritorious Service Award and Silver Medal of the Department of the Interior and all five received gifts and remembrance books signed by their many friends. Among those who spoke during the evening were C. W. Merrill, W. C. Schroeder, R. R. Sayers, O. C. Ralston and W. E. Rice. James Boyd, former director of the Bureau, summed up and gifts were presented to each of the honorees. Among those who made the presentations were: Hope Anderson, L. L. Newman, C. H. Johnson, Paul Allsman and Edward Maye. (Photos by Kenfield Bailey)

Pitt-Consol Enters Chemical Business

Pittsburgh Consolidation Coal Co. is establishing a modern cresylic acid refinery at Newark, N. J., which will be operated by its newly formed subsidiary, Pitt-Consol Chemical Co.

Joseph Pursglove, Jr., vice-president of research and development and president of Pitt-Consol Chemical, reports the coal company has acquired the Newark plant of the Reilly Tar & Chemical Corp. Pitt-Consol will start immediately to construct new facilities and to renovate certain existing units. Upon completion of its present construction plans, the over-all investment will be $3 to $3½ million.

Products from the new plant initially will include high purity cresols, cresylic acids, phenol, resins and molding powders. There is a concentrated market for these materials in the chemicals and plastics industries on the Eastern Seaboard. "Other products for this operation are being developed," Pursglove said, "and we expect to make additions to the Newark product list from time to time."

In reviewing the background for the move, Pursglove said:

"Our research in coal carbonization and the refining of the liquids thus obtained has resulted in a process for producing a new quality of cresylics and related materials. While the process will enable us to use petroleum refinery waste streams as the primary feed material, the Newark plant will also provide an outlet for the most valuable fractions of liquids from coal carbonization plants. Our process of low temperature carbonization is now ready for commercial use. As such projects materialize, the liquids from carbonization plants can form the basis for further expansion of our chemical refining operations."

The plant will have excess steam capacity and the 48-acre site has ample space for future expansion. The property has its own deep water dock frontage, is served by rail, and is close to New Jersey's turnpike. The new facilities will begin operations in mid-1956 but a portion of the old plant will be operated meanwhile to produce present grades of cresylic acids, resins and molding powders.

Fields Creek Mine

The former Kanawha Coal Sales Co. mine on Fields Creek near Winifrede, W. Va., has been bought by Cornett, Ward & Russell Mining, Inc. The new owners expect to install modern equipment at the Fields Creek mine and intend to increase production.

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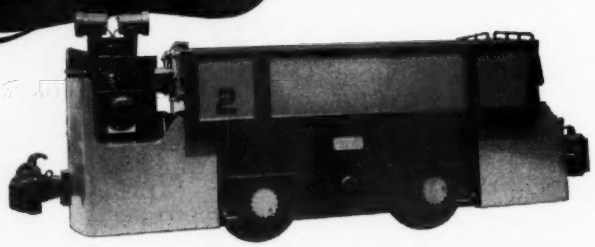

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Expand Rare Earths Program

W. R. Grace & Co. has announced that its Davison Chemical Co. Division and Rare Earths, Inc., Pompton Plains, N. J., a wholly-owned subsidiary, have joined in a program of expanded production, sales, research and development of rare earths and thorium.

Rare Earths, Inc., has a plant in operation at Pompton Plains for processing rare earths and thorium from monazite sands, and additional facilities are being installed at Davison's Curtis Bay Works (Baltimore).

To coordinate Grace's interests in the field of industrial atomic energy, Davison has formed an Atomic Developments Department with headquarters at Baltimore. Marlin G. Geiger, Davison president, has named as manager Dr. Allen T. Cole, formerly manager of the company's Florida Phosphate Division, Bartow, Fla.

Coal Companies Merge

Stockholders of Island Creek Coal Co. and Pond Creek Pocahontas Co. have approved merger of the two companies under the Island Creek name effective August 31. The two companies have been joinly managed for many years and have sold their product through Island Creek Sales Co. R. E. Salvati, president of both companies, stated that a merger would contribute to the financial position and strength of both companies and would enable the combined organization to take advantage of opportunities for additional ventures.

At the present time, Island Creek is producing 31,500 tons of coal daily and Pond Creek is producing 12,500 tons.

American Zinc Leases Property

Howard I. Young, president of American Zinc, Lead and Smelting Co., has announced that the company had acquired from the Cuba City Mining Co., Cuba City, Wis., leases on the Thompson and Temperly properties comprising 370 acres in the southern Wisconsin mining area on which a substantial tonnage of zinc ore has been proven. The company has been drilling on these and other Wisconsin properties for several months.

It is anticipated that the mine will be in production the second quarter of 1956 at which time it is expected that production will be at the rate of 12,000 tons a year of 60 percent zinc concentrates.

The company has arranged to acquire the milling facilities of the Vinegar Hill Zinc Co. and mining leases and equipment held by that company in the southern Wisconsin mining area. Drilling on the Vinegar Hill properties has indicated a tonnage of commercial ore which, together with the tonnage produced from the Cuba City properties and other sources, will supply the mill capacity for a period of from six to eight years. The mill has a daily capacity of 800 tons of ore. The combined properties being acquired should, under present zinc market conditions, produce from 18,000 to 25,000 tons of combined zinc-lead concentrates a year.

The Youngstown Sheet and Tube Co. of Youngstown, Ohio, is the principal owner of the Vinegar Hill Zinc Co.

1956 AMC Coal Convention

WITH the appointment of G. A. Shoemaker, executive vice-president, Pittsburgh Consolidation Coal Co., as chairman of the Program Committee, plans for the 1956 American Mining Congress Coal Convention are getting under way. Mr. Shoemaker and a nation-wide committee of coal mine operators and equipment manufacturers will handle the highly important job of selecting subjects and organizing convention sessions to bring the industry up to date on the latest advances in coal mining methods and equipment and coal cleaning technology. To them will also fall the task of selecting the best qualified speakers to present the topics chosen.

Suggestions as to subjects and speakers should be sent to the American Mining Congress, Ring Building, Washington 6, D. C. Early in November the Program Committee will meet to consider the many suggestions submitted by that time and to select a comprehensive, well-rounded program.

May 7-9 next year is the period when coal mining men from all over the country will gather at the Netherland Plaza Hotel in Cincinnati for the outstanding coal meeting of the year. With a record turnout expected, an early request for hotel accommodations is advisable. Write or wire direct to the hotel of your choice.

Underground Limestone Quarry

The Columbia Cement Division of the Pittsburgh Plate Glass Co. is converting from quarrying operations to underground limestone mining to supply raw materials at its East Fultonham, Ohio, cement plant. Made necessary by the depletion of suitable limestone from the company's quarry, the deep mine is expected to be completed within two years. Stone will be crushed and sized in the mine close to the working faces and carried by a 1000-ft belt conveyor to the mine entrance. Annual production will be 600,000 tons.

At the present time approximately half of the cement plant requirements have been coming from the deep mine, and the remainder comes from the quarry which is to be abandoned.

Sales and Engineering Corporation

Two Panther Valley anthracite mining companies have announced a cooperative arrangement on sales, engineering and accounting designed to improve their competitive position in the industry. The statement was issued jointly by executive vice-president Joseph J. Crane of the Panther Valley Coal Co., Inc., and John S. Marshall, executive vice-president of the Coaldale Mining Co., Inc.

Last fall the Panther Valley firm leased the Lansford, Pa., area mining operations of the Lehigh Navigation Coal Co. and the Coaldale Co. leased Lehigh Navigation properties in the Coaldale area.

Canadian Uranium Policy

The Government of Canada has announced it will negotiate no more special price contracts with uranium mill operators who cannot get their plants into operation before April 1, 1957.

This action is expected to reduce concentrator construction in Canada's Blind River district.

The growing concern over the price structure of world uranium markets expressed by the U. S. Atomic Energy Commission is believed by observers to have had considerable influence upon the decision made by Trade Minister C. D. Howe of Canada.

Eight Million Tons of Coal Without a Fatality

A NEW national safety record for tonnage of coal mined without a fatal accident has been established by Jones & Laughlin Steel Corporation's Vesta No. 4 Mine at California, Pa.

This was revealed July 28 at a dinner at the Nemacolin Country Club, near California, Pa., where all the J & L coal mines received The Joseph A. Holmes Safety Association Award for having produced 7,967,039 tons of coal without a fatality. However, the non-fatality record continued to 8,272,364 tons beyond the award date. Three of the mines received individual Holmes Safety Association Certificates of Honor.

The new safety record set by Vesta No. 4 is for mining 7,111,605 tons without a fatal accident as of July 28. This non-fatality period started on October 11, 1951 and is continuing.

The previous record was held by U. S. Fuel Company's No. 2 Mine at Gary, W. Va., for 6,770,083 tons of production from July 1, 1939 to April 15, 1944 without a fatality. Third place is now held by Island Creek Coal Company's No. 7 Mine with 6,751,947 tons and fourth is Eastern Gas & Fuel's Federal No. 1 with 6,378,874 tons.

The general award to the J & L Mines covered Vesta No. 4 and No. 5, Shannopin and the Black Eagle, in Mullens, W. Va. In making the presentations, J. J. Forbes, director, U. S. Bureau of Mines, pointed to the J & L mine safety record as "outstanding". He said it was a far cry from the days when the mining of 300,000 or 400,000 tons of coal without a fatality was considered a good safety record.

Speakers at the dinner included: Admiral Ben Moreell, chairman of the board, Jones & Laughlin Steel Corp.; C. L. Austin, J & L president; Harry M. Moses, president, Bituminous Coal Operators' Association; Joseph Yablonski, International Executive Board Member, U. M. W. A.; Lewis G. Evans, Deputy Secretary of Mines, Commonwealth of Pennsylvania; E. R. Cooper, general manager of J & L Coal Mines and Charles Ferguson, Safety Director, U. M. W. A. Wm. E. Hess, manager of coal mines for J & L, acted as master of ceremonies.

C. L. Austin (seated), president of Jones & Laughlin Steel Corp., looks on as J. J. Forbes (right) director of the U. S. Bureau of Mines reads the citation of the Certificate of Honor presented to the steel company. Standing with Mr. Forbes are, left to right, David Page, general superintendent of J&L's Vesta-Shannopin Division; Thomas Park, safety director of the Division; and H. T. Bartram, general superintendent of Black Eagle Mine at Mullens, W. Va.

Besides the award to Vesta No. 4, other Certificates of Honor awards were presented to Vesta No. 5 for having produced 3,313,881 tons of coal from July 14, 1953 to February 1, 1955, without a fatality; and to Shannopin for 1,662,806 tons of coal production from April 21, 1952 to February 1, 1955, without a fatal accident. The non-fatality records of both these mines are continuing.

More than 200 persons attended the dinner. They included representatives of the Bureau of Mines; Pennsylvania State Department of Mines; the United Mine Workers of America; the Bituminous Coal Operators Association, the American Mining Congress and the union Mine and Safety Committees of the mines.

This group gathered for a final look at the Joseph A. Holmes Safety Association award. Left to right, they are: Admiral Ben Moreell, J&L Board Chairman; J. J. Forbes, Director, U. S. B: M.; Harry M. Moses, President, Bituminous Coal Operators Association; Joseph Yablonski, International Executive Board Member, U. M. W. A.; C. L. Austin, President, J&L; W. E. Hess, Manager of Coal Mines, J&L; and L. G. Evans, Deputy Secretary of Mines for Pennsylvania

President of Jones & Laughlin, C. L. Austin (right), was on hand at the dinner to deliver his congratulations to these two other J&L officials directly involved with the safe mining record of the corporation. With him at the speakers' table are William E. Hess, manager of Coal Mines for J&L (left), and (center), E. R. Cooper, General Manager of Coal Mines for the corporation. J&L operates coal mines in Pennsylvania and West Virginia

Giant Cement Expansion

Giant Portland Cement Co. has revealed its plans to expand its Harleyville, S. C., plant and boost cement capacity there 60 percent. Expansion will increase cement production from 1,800,000 bbls a year to nearly 3,000,000 bbls. annually. Giant has acquired 600 more acres of land adjoining its Harleyville plant and says that this will be sufficient to provide raw materials for the expanded plant in the years to come.

The company operates another plant at Egypt, Pa.

29 DMEA Contracts During July

Twenty-nine new contracts for minerals exploration assistance were executed during July 1955, by the Defense Minerals Exploration Administration.

Total estimated cost involved in the 29 contracts is $668,795, with the Government's portion not to exceed $483,993. The contracts are with operators in nine States, and cover explorations for six different minerals.

DMEA Administrator C. O. Mittendorf said the contracts executed during July bring the total to 796 executed since the beginning of the program four years ago.

About one-third of the new contracts were for uranium exploration projects, with mica projects comprising another one-third of the total number. Largest estimated exploration cost was $95,260 for mercury explorations in California. Smallest contract was for a mica project in North Carolina, with a total estimated exploration cost of $3100.

Close One Mine—Open Another

Hoskins Mound, which has been in operation longer than any other U. S. sulphur mine, was closed on May 27 due to the exhaustion of the deposit.

Freeport Sulphur Co. began production in 1923 at the mine near Freeport, Tex. Since that time Hoskins has produced about 11,000,000 long tons of sulphur.

In its annual stockholder reports the company for several years has pointed out that Hoskins output was declining and costs rising and that the reserves were approaching exhaustion. The life of the mine was extended, however, by the increase in the price of sulphur which took place in the middle of 1953.

In an effort to minimize the effect of the closing, many workers have been transferred to Freeport's other mines, and those who had to be laid off were paid termination benefits based on service and age and amounting in many cases to more than a year's pay.

Annual Conference of the Coal Division

William Penn Hotel, Friday, November 18, 1955

COAL OPERATORS and manufacturers of mining equipment are invited to attend the Annual Conference of the AMC Coal Division which will be held at the William Penn Hotel in Pittsburgh, Friday, November 18. Six committees as listed below will present reports on studies that are now completed or are in progress; copies will be available and all present will be invited to submit comments and suggestions from the floor.

The purpose of the committee studies is to present to the industry accounts of mine practices, with new and improved types of equipment, that are being operated successfully under various seam conditions. A wide range of subjects covered by the reports will include: Mechanical Loading into Mine Cars, Service Haulage with Conveyors, Shuttle Car Gathering, Cable Splicing, Main Line Haulage, Mine Lighting, Roof Bolting, Trailing Cables, Equipment Maintenance, Coal Dust Control Underground, Washery Water Clarification, and Industrial Engineering.

Committee on Coal Preparation	**R. L. LLEWELLYN, Chairman**
Committee on Conveyor Haulage	**H. A. JONES, Chairman**
Committee on Mechanical Mining	**WM. E. HESS, Chairman**
Committee on Rail Haulage	**J. D. REILLY, Chairman**
Committee on Roof Action	**C. O. KANE, Chairman**
Committee on Underground Power	**JOHN A. DUNN, Chairman**

The company previously had announced installation of facilities to produce sulphur from a newly discovered salt dome deposit in the Louisiana tidelands. The deposit, known as Lake Pelto, is located near its Bay Ste. Elaine mine about 60 miles southwest of New Orleans.

Beneath six to eight ft of water, Lake Pelto is within a mile of the open Gulf, being separated only by a narrow island.

Prospecting operations by Freeport were begun there early this year, and drilling has progressed to the point where a decision has been reached to install facilities to mine the property, according to the company's statement.

To Increase Output

A program has been started at the Russell Fork Coal Co., Elkhorn City, Ky., to increase annual tonnage output 100 percent over the next two years.

Honored for Lignite Research

Texas Power & Light Co. of Dallas, Tex., was given the Charles A. Coffin Award for 1954, in ceremonies conducted June 15 at the 23rd annual convention of the Edison Electric Institute in Los Angeles.

The award was presented to W. W. Lynch, TP&L president, by Philip D. Reed, chairman of the board, General Electric Co. The award is presented annually by G. E. through the Edison Electric Institute to the electric utility company judged as making the greatest contribution to the advance of the industry and service to customers.

In selecting the winner this year, the judges cited Texas Power & Light Company "for extraordinary enterprise and resourcefulness in uncovering and developing the extent and value of untapped natural resources . . . and for its contribution to the industrial and agricultural development of Texas."

Important among the reasons Texas Power & Light Co. won the award were its research program of preparing and using lignite in power plant boilers, pointing toward the development of a low-cost fuel for production of electric power, and the use of this natural resource for the further industrialization of the TP&L service area.

After some 13 years of experience using lignite as a fuel for its Trinidad generating station prior to 1940, the company, in 1948, began an extensive research program, working with the U. S. Bureau of Mines, to determine how Texas lignite could be used more effectively as a fuel.

The results obtained in this program were largely responsible for the location in Rockdale, Tex., of the new smelting plant, the Aluminum Co. of America.

In the citation by the Coffin Award judges, TP&L's lignite investigations are commended as "nationally recognized to be of benefit to the industry and the public by opening up the potentialities for economic exploitation of the nation's vast and largely undeveloped deposits of lignite and other low rank, non-coking fuels."

Gets Coal Scholarship

Stanley B. Johnson Jr., president of the Lorado Coal Mining Co., has announced that the company is awarding a scholarship at West Virginia University to Lowell Adkins of Lorado, W. Va.

Adkins, son of an employe, graduated this year from Man High School with an outstanding record, ranking fourth in his class.

Adkins will enter West Virginia University this fall in the Coal Mining Engineering course, along with Doran Nester and Lowell Leach, who were awarded similar scholarships by the Lorado company last year.

N. J. Zinc Develops New Mine

The New Jersey Zinc Co. has started development work on its recently acquired Flat Gap property at Treadway, Tenn., 25 miles from its Jefferson City property where a similar project has been under way for the past two years. Operations are in charge of Johnson Crawford, Tennessee superintendent for New Jersey Zinc.

Two shafts are to be sunk—one for service and the other for ventilation. Shaft sinking operations were to begin in September.

Trackless mining will be employed at Flat Gap. All underground ore haulage will be by diesel trucks. Also, trucks will be used to transport concentrates from the proposed mill, which will treat 2000 tpd of zinc ore, to a railroad shipping point at Morristown, Tenn.

The ore body is a lead-free zinc sulfide ore, typical of occurrences in Eastern Tennessee.

Medusa Kiln Operating

In a letter to shareholders, the Medusa Portland Cement Co. recently announced that the new kiln at York, Pa., cement plant is expected to be in full operation during the third quarter of 1955. The letter went on to announce that plans are under way for the installation of a second kiln and auxiliary equipment at the plant. The initial work on the Dixon, Ill., plant expansion has started, with an expected completion date late in 1956.

PURCHASING AGENT

Large industrial company, NYC, is interested in man under 32 with technical education and 3 or more years coal-mining experience for position in central purchasing dept. buying coal for power and process use. Send resume of education and work experience to BOX No. 333.

Barvue Mining Plan

Barvue Mines which now operates in open-pit mines in northwestern Quebec, plans to increase the zinc content of its ore by a combination of open-pit and underground mining. This would be done by rigging the open-pit with a tunnel having a 10° gradient which would penetrate 275 ft below the floor of the open-pit. Mining would be conducted from the tunnel and the ore brought to the surface with the large trucks now hauling it from the open-pit. This system will permit selective mining which is expected to raise ore grade by about 1.25 percent.

Pick-up Truck Takes to Air

Pocahontas Fuel Co., if it has not already done so, will soon put into operation a two-seat, single-engine airplane to make regular flights between the main offices at Pocahontas, Va., and mines at Bishop and Amonate, Va., and Itmann, W. Va. Two flights daily to each mine will carry records, machinery parts and coal samples, etc. In the past such material has been transported over the mountains by car.

Pocahontas Fuel has had for some time a two-engine plane to take officials on long trips. However, this is believed to be the first time a small plane has been used in the area to make regularly scheduled flights between the home office and the mine sites.

Consider Aluminum Plant

St. Joseph Lead Co., in a letter to stockholders reporting activities for the first six months of 1955, revealed that Pittsburgh Consolidation Coal Co. and St. Jo are considering the advisability of building on a joint ownership basis a 66,000-ton aluminum reduction plant and a 225,000-kilowatt power station at Josephtown, Pa. The facilities would adjoin the electrothermic zinc smelter of St. Jo at that city. The report went on to say that the detailed study of the preliminary $80,000,000 capital expenditure and operating cost for the project should be completed soon. Another important factor before decision can be reached, the letter concluded, will be the Government's policy towards increased domestic aluminum production.

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Canadian Columbium-Tantalum

An announcement has been made that Kennecott Copper Corp. and Molybdenum Corp. of America have executed an agreement for the development of columbium-tantalum mining properties in the Oka, Que., area of Canada. In addition, Kennecott has agreed to purchase 50,000 shares of molybdenum stock.

Expand Zinc Plant

American Smelting & Refining Co. has announced that the capacity of its electrolytic zinc plant at Corpus Christi, Tex., will be increased about one-third when an expansion program is completed sometime in 1956. The larger plant will have a capacity of 9000 short tons of zinc monthly as compared with the present output of 6500 tons.

The new unit will duplicate a similar facility built during the Korean War for the treatment of zinc fume. The zinc fume is recovered for raw material from lead mine slags and other smelting plants owned by the company.

Marquette Expansion

Marquette Cement Mfg. Co. in mid-August announced a $16,000,000 expansion program which will add nearly 3,000,000 bbls of cement to its annual capacity. One billion two hundred thousand bbls of the increased capacity will come from either a new plant in the Chicago area or from enlarged facilities of the Oglesby, Ill. plant of the company. A study is now under way to decide which course will be followed.

Other expansion plans include a 1,200,000-bbl increase to the company's Cape Girardeau, Mo., plant and a 400,000 to 500,000-bbl increase at its plant in Des Moines, Iowa. Efforts will be made to have all three projects completed by the end of 1956.

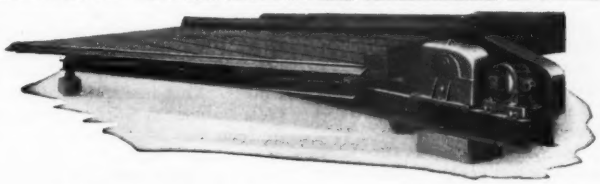
Construction at the Des Moines plant will begin immediately. The addition will bring total annual production of the plant to 2,500,000 bbl. The annual capacity of the Cape Girardeau plant after expansion will be 3,000,000 bbl.

Peabody Sinclair Merger

In an exchange of stock between the Sinclair Coal Co. and the Peabody Coal Co. of Chicago, Ill. July 25, a challenge was issued for the title of largest coal producer in the United States. Until now, Pittsburgh Consolidation Coal Co. has held that title. It produced 22,916,792 tons in 1954, closely followed by the U. S. Steel Corporation's captive mines with a total of 22,677,697 tons. The recent combination of Sinclair and Peabody tonnage leaves the enlarged Peabody with an expected annual production between 20,000,000 and 25,000,000 tons.

The eight coal companies making up the Sinclair Coal Co. holdings were acquired by Peabody for an exchange of 6,492,164 shares of Peabody stock, issued for the purpose following SEC approval of the plan. The companies now becoming a part of Peabody Coal are the Sentry Royalty, Power Coal, Homestead Coal, Sinclair Coal, Key Coal, Broken Aro Coal and Alston Coal companies, and Sinclair Mines, Inc. The resulting company now has assets totalling more than $100,000,000.

At a meeting of the board of directors of the Peabody Coal Co. held in Chicago July 25, Otto Gressens, Peabody president, was elected chairman of the board and L. Russell Kelce, Sinclair president, was made president succeeding Gressens. Merl C. Kelce who was vice-president of the Sinclair group, was elected executive vice-president of the new company.



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BOOK REVIEWS

GEOLOGY OF SOUTHERN CALIFORNIA BULLETIN 170. *State of California Division of Mines. Price $12.00 (+ 3% Tax to California Residents).*

A NEW comprehensive bulletin entitled *Geology of Southern California* has just been released by the Division of Mines. The book, consisting of some 878 pages of text, 441 text figures, an index map, 60 route maps to selected geologic trips, and 34 map sheets with texts and illustrations, is the product of 103 technical experts—men in academic, industrial, and government positions. Compiled and edited by Professor Richard H. Jahns of the California Institute of Technology, the bulletin is essentially a gigantic symposium on the geology of southern California.

Issued as *Bulletin 170* in the Division's series, the book comes in a sturdy cardboard box, 13 in. long by 9½ in. wide by nearly 4 in. thick; inside the box are the separately bound chapters (10 and preface), five road logs, also separately bound, and 34 map sheets. The map sheets are encased in an expanding envelope. The 34 map sheets are by no means all of the maps included in the volume: most of the parts have maps included in pockets in the backs. For example, one large map included in Chapter II is a map showing the geology of the Los Angeles Basin; lithographed in color, it is the only portion of *Bulletin 170* that may be separately purchased. The price of the entire volume is $12.00, plus 3 percent tax for California residents. The volume is sent to purchasers postpaid. (Shipping weight is 10 lb.) Copies may be ordered from the Division's San Francisco office, Ferry Building, or may be purchased over the counter at the San Francisco offices, and Los Angeles, Sacramento, and Redding offices.

PIPE FRICTION MANUAL. *Copyright, 1954. Size 8½ x 11 in.: paper bound, 87 pages. Published by The Hydraulic Institute, 122 East 42nd St., New York 17, N. Y. Price $1.75 domestic, $1.85 foreign.*

MATERIAL in this Manual is an extension and rearrangement of the pipe friction data contained in an earlier publication entitled, "Tentative Standards of the Hydraulic Institute—Pipe Friction."

The Manual features a section demonstrating the mathematical calculations used in the construction of water charts. This is supplemented by complete tables of friction loss for water in feet per 100 ft of pipe. Wrought iron, steel and cast iron pipe sizes from ⅛ in. nominal to 84 in. I.D., are covered. Given also, are tables of resistance coefficients for valves and fittings, 90 degree bends, diffusers, and others. The tables of resistance coefficients for valves and fittings include the latest available experimental data and show the values in more detail with respect to size and type than has heretofore been published.

Full page charts, showing friction loss for the incompressible flow of viscous fluids for pipe sizes from ½ in. through 12 in., have been redrawn for greater clarity. Also included are three fold-in charts of friction factors with related data to permit the calculation of the friction loss for any fluid (liquid or gas) in any size or shape of conduit.

Of particular utility are numerous examples showing actual mathematical solutions to pipe friction problems.

With the combination of formuli, friction loss moduli, friction factor charts, roughness factor charts, viscosity tables and associated information, the Pipe Friction Manual is a most complete and workable treatise on the subject. It also includes a full list of the references showing the sources of the data. It should fill a long time need for a thorough and authoritative handbook on pipe friction.

BIBLIOGRAPHY ON URANIUM IN ARKANSAS, IOWA, KANSAS, LOUISIANA, MINNESOTA, NEBRASKA, NORTH DAKOTA, OKLAHOMA, SOUTH DAKOTA AND TEXAS. *The Geological Society of America, 419 West 117th St., New York 27, N. Y. 70 pages, prices 50 cents.*

THE Geological Society of America published the following article in the March 1955, issue of its Bulletin: "Bibliography and Index of Literature on Uranium and Thorium and Radioactive Occurrences in the United States. Part 4: Arkansas, Iowa, Kansas, Louisiana, Minnesota, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota and Texas," by Margaret Cooper for the Division of Raw Materials, U. S. Atomic Energy Commission. Since this 70-page bibliography may prove helpful to both geologists and laymen interested in uranium prospecting, the Society has prepared reprints for public sale at 50 cents per copy. Remittance must accompany orders.

JUST 45 YEARS AGO, in 1910, the first long-boom, full-revolving American stripping shovel was built and shipped to a Kansas coal field by a company which was later acquired by The Bucyrus Co. of South Milwaukee, Wis., now known as Bucyrus-Erie Co. Equipped with 55-ft boom and 40-ft handle, the steam-powered machine carried a 2½-cu yd dipper and had a working reach of 31 ft. It was the forerunner of the great crawler mounted, electric driven coal strippers of today.

Kohinoor Colliery Collapses

Apparently weakened by excessive rains, the Kohinoor Coal Breaker at Shenandoah, Pa., collapsed August 22 killing three men and seriously injuring 11 others. Only 26 men instead of the usual 150 were at work at the time. Incessant rains and the flood waters which followed had delayed the delivery of freshly mined coal to the breaker plant. This accounted for the reduced work force.

Move Accounting Department

Amherst Coal Co. has transferred its accounting department from Lundale, W. Va., to Reed, W. Va., thus centralizing all company accounting in Reed. Lundale remains headquarters for the operating office, purchasing director, manager of stores, and vice-president of engineering. Amherst had maintained bookkeeping facilities at Reed for its other properties, the Amherst Barge Co. and Campbell Creek Railroad.

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Work Out Two Mines

Officials of the United States Steel Corp. have announced that its National No. 3 mine at Muse, Pa., will be abandoned. Operations at the mine were suspended in July 1944 after 31 years of operation. It was the last mine offering employment in Cecil Township, Pa., and exhaustive efforts were made by the company and the community to secure an outside operator. These have failed, however, and recent action of the Steel Corporation allows the surface buildings to be placed on the market for lease or sale to other industries which would provide employment in the area.

There is a limited supply of unexhausted coal in the mine, but it is not of metallurgical grade and apparently cannot be mined competitively in the existing market for steam coal.

During the last year pumping and ventilation were continued to keep the property in accessible condition.

Uniontown, Pa., office of the Frick Coal Division in the United States Steel Corp., had previously announced the closing of the Ronco mine in Fayette County, Pa. The Steel Corp. had warned earlier this year that the mine would soon be "worked out" and that the closing would occur when the coal supply became exhausted.

Drilling Symposium

The University of Minnesota will present its fourth annual drilling symposium October 13, 14, and 15 at the Center for Continuation Study on the Minneapolis, Minn., campus. The subject chosen by the Planning Committee for treatment this year relates to the use of tungsten carbide in rotary exploration drilling. The symposium will begin with the nature of tungsten carbide, then various factors important in the mounting or arrangement of tungsten carbide in bits will be discussed. This will be followed by accounts of experience with rotary drill in the United States and abroad. The feature of this part of the discussion will be reports from the continental European experts. The symposium will then consider the use of combined rotary and percussion methods and will conclude with the usual general round table discussion on Saturday morning, October 15.

Inquiries about the program and application for registration should be sent to the Director of the Center, Continuation Study, University of Minnesota, Minneapolis 14, Minn.

Molten Sulphur Shipped

The first cargo of molten sulphur has been transported by sea from Port Sulphur, La., to Everett, Mass. The sulphur was carried in the specially constructed, heavily insulated hold of the S. S. Chemical Transporter, which carried a 25-ton shipment purchased by the Monsanto Chemical Co. for its Inorganic Chemicals Division.

R. L. Miller, manager of Monsanto's plant at Everett, said the new method of handling sulphur will permit a saving in time and money and will eliminate nuisances involved in handling dry sulphur.

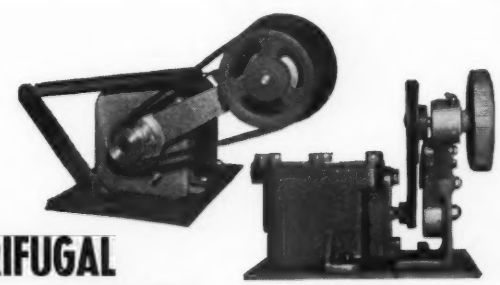
Virginia Mineral Find

Virginia Mining Corp., with headquarters in Montreal, Quebec, has recently announced that it has uncovered a major, mineral-rich three-mile front which appears ripe for development for lead, zinc, and copper ores near Dillwyn, Va. The Buckingham County, Va., area where the find was reported was considered the nation's leading gold-mining region more than 100 years ago but has lain largely dormant since.

The Montreal firm has been conducting exploratory core-drilling operations for about 2½ years on the site of the old London and Virginia mine, one mile north of Dillwyn. The recent announcement, however, was based on results of an aerial survey of a ten by twenty-mile area which was flown with electromagnetic instruments only a few weeks earlier. According to the company the results of this survey completely overshadow the previous discovery. The aerial survey disclosed several similar zones as large or larger than the earlier one.

Complete Safety Course

Approximately 600 miners of the Semet Solvay Allied Chemicals Co. operation at Tralee, W. Va., were honored July 30 in ceremonies at Bluefield, W. Va., for 100 percent participation in a first aid course. The course consisted of 20 hours of classes for each miner and was taught by the West Virginia Department of Mines. Classes were held two hours a day, five days a week, until completion in mid-July.



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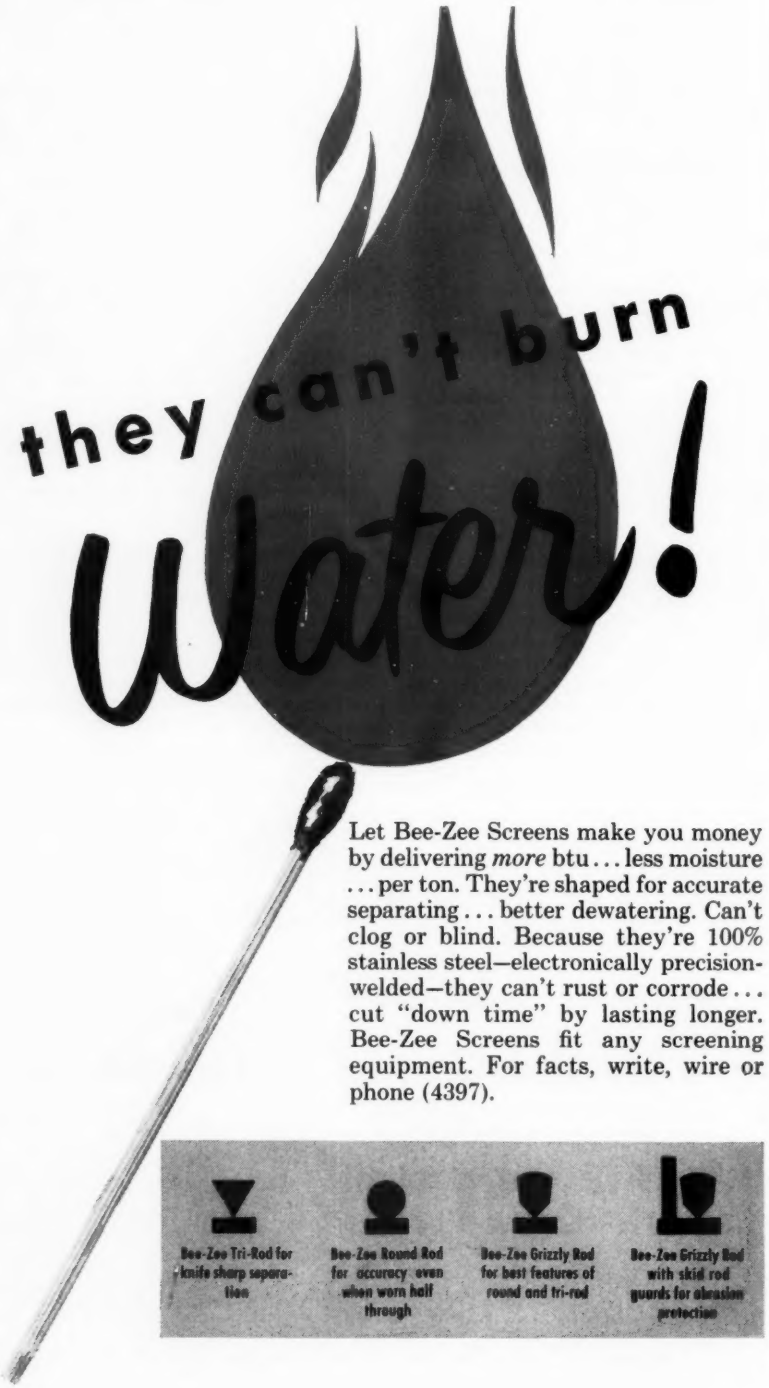

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Add to Cement Capacity

In January 1955, Peerless Cement Corp. purchased a 14-acre plot of land on the Rouge River near the present Detroit, Mich., plant. Now, construction of a $7,500,000 plant has been started. The new plant will have a 1,000,000 bbl annual capacity and the company believes that it will be in production in September 1956.

Power Reactor

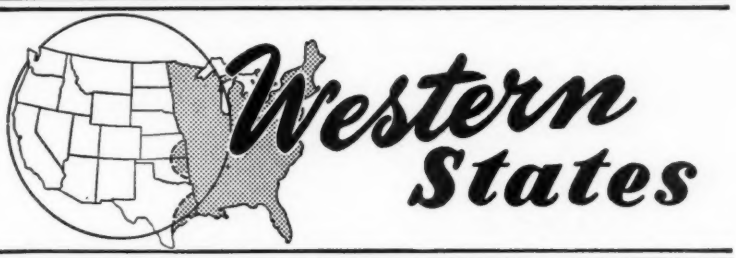
(Continued from page 67)

accomplished. The imagination and ingenuity of industrial scientists and engineers operating under traditional incentives are vital to the solution of the cost problems.

A major area of unresolved problems is the fuel cycle, particularly the chemical processing of a variety of fuel elements on a small scale from different power reactors which will go into operation during the next 5 to 10 years. Boldness and aggressiveness will be needed to solve this problem which now is the crucial problem in the development of economically competitive power reactors.

The United States has directed its power reactor development program in the direction of "power only" reactors rather than follow the "dual-purpose" approach. This seems desirable for technical reasons as well as for other reasons. Dual purpose reactors may be useful if plutonium production goals are expanded, but they will not in themselves lead to the development of economically competitive power-only reactors. Government assistance to private industry may be required for some time to come to achieve the desired goal and must be provided in a manner which will preserve the conventional industrial incentives.

In short, our question is not whether we will achieve economic nuclear power—but when we will achieve it. A further and important question is the impact which it will have on our industrial pattern and economics as well as that of the world as a whole. These are questions which deserve early study.



Uranium Truck Tunnel

The Big Horn Uranium Co. of Monticello, Utah, has signed a contract with the new Newam Co., Vancouver, B. C., for driving an 1800-ft truck-sized ore tunnel through Big Horn property. Newam is an affiliate of Pioneer Gold Mines Co. which has an interest in the Big Horn properties.

The tunnel will be one of the largest such projects undertaken in the district this year.

To Surface Mine Uranium

An extensive open pit mining program to uncover an estimated minimum of 60,000 tons of uranium ore will be started within a short time by Continental Uranium, Inc.

Gerald Gidwitz, board chairman of the company, said that Continental expects to strip a new area of 140,000 sq ft immediately north of its present strip mine operations at the Rattlesnake mine near Moab, Utah.

The operation, which will require deeper mining than that needed at present Rattlesnake locations, will involve moving more than 1,500,000 cu yd of earth to uncover the ore deposits. The decision to undertake this major mining program was reached by company engineers and management after drilling tests showed substantial and widespread ore deposits, Gidwitz said.

Continental's corporate offices are in Chicago. Its field offices are in the Continental Uranium Building, Grand Junction, Colo.

Consolidate Interests

Formation of International Oil & Metals Corp. to operate extensive and varied mining enterprises has been announced by W. Dale Bost, chairman of the board.

The new firm is the outgrowth of a group which has been operating as a syndicate for a number of years, comprised of International Iron Mines, Ltd. of Canada, International Metals Corp. of Idaho, Montana-Arizona Copper Mines, and Silver Ridge Mining Co., Ltd. of Canada. Control of these companies has already been acquired and a merger proposal has been made to Alabama-California Gold Mines Co.

One of the major operations of the new company will be the Nimkish Iron Mine on Vancouver Island. Bost said that more than 2,000,000 tons of high-grade ore have been blocked out on this property and $1,000,000 will be spent in the next 12 months to construct a beneficiating and processing plant. Drilling operations are now in progress on the property and a seven-mile rail line to serve the operation is under construction.

Directors and officers of International Oil & Metals are Bost, Hugh C. Van Valkenburgh, Seattle, president; Harry F. Magnuson, Wallace, vice-president; Kenneth J. Selander, Seattle, secretary; Floyd Clodfelter, Seattle, treasurer; C. T. Takahashi, Seattle, treasurer in charge of foreign operations, and Gordon Holt, Salt Lake City, director.

Day Develops Uranium

Day Mines, Inc. has acquired eight mining claims, plus 120 acres of adjoining land in Ferry County, Wash. for development of uranium. The property was acquired from Newland and Sullivan under a 25-year profit-sharing lease.

Galena Silver-Copper Ore

American Smelting & Refining Co. has confirmed a report that silver-copper ore has been opened on the new 3400-ft level in the Galena mine, west of Wallace, Idaho.

Joseph C. Kieffer, assistant manager, said the vein looks about the same as on the 3000-ft level where it was discovered two years ago.

A. S. & R. is operating the mine under a long-term lease from Vulcan Silver-Lead Corp., a subsidiary of Callahan Zinc-Lead Co. Day Mines, Inc., has a 25 percent participating interest in the lease.

Utah Gilsonite Expansion

American Gilsonite Co. will spend $10,000,000 in expanding its mining operation in Uintah County, Utah, according to Ernest F. Goodner, president.

Production of gilsonite will be increased from 500 to 1000 tpd through use of a new method of hydraulic mining to dislodge the hard, brittle, black hydrocarbon from veins at the Bonanza Mine near Vernal. The new hydraulic method, using nozzle pressures greatly in excess of those employed in placer gold operations, will eliminate the use of any type of explosive.

The large volume of water involved will also be used to transport ore in ditches along levels to the shaft and up the shaft to the surface. After "ore" and water are remixed on surface, they will be transported via eight-in. pipeline to the refinery and coke plant in western Colorado.

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Arizona Copper Option

Cyprus Mines, Inc., Los Angeles, has optioned Union Oil Company's high grade ore reserves southwest of Tucson, Ariz., for further exploration. Union's copper reserves were discovered by Pima Mining Co., a wholly-owned subsidiary. Horizontal drilling on the property has indicated a substantial ore body.

Uranium Plant at Maybell, Colo.

Signing of a contract by the U. S. Atomic Energy Commission and the Trace Elements Corp., of Grand Junction, Colo., for the construction and operation of a uranium ore-processing plant at Maybell, Colo., has been announced. Maybell is on the Yampa River in Moffat County in northwestern Colorado.

The new plant, to be constructed, owned, and operated by Trace Elements, will process uranium-bearing ores from northwestern Colorado including ores owned, leased, or controlled by the corporation, as well as ores purchased from independent producers. The facility will provide a market for the small producers in this area who are too far removed from existing mills to produce economically or whose uranium ores are not amenable to present processes.

Prior to construction of the full-scale processing plant—planned for late 1956 or early 1957—the Trace Elements Corp. will carry out pilot plant tests on the ores in that area to develop design criteria for the new plant.

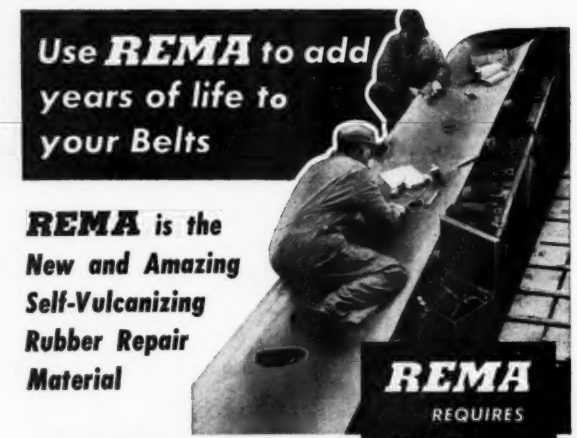
Potash Expansion

Southwest Potash Corp., a subsidiary of American Metal Co., Ltd., has undertaken the first major expansion of its potash mine and mill at Carlsbad, N. M., since it began operations in late 1952. Its capacity will be increased by one-third at an estimated cost of $2,500,000. The new facilities should be ready by February 1956.

Sell Rattlesnake Claims

Rattlesnake group of gold mining claims, idle for some time, in the Gold Mountain District near Goldfield, Nev., has been sold.

W. Emil and Susie Patten made the sale to T. M. Racey and V. E. Smith. The purchasers immediately announced that the N & N Development Co. of Los Angeles has taken an option on the property.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Mercury Refining Plant

Rare Metals Corp., a subsidiary of El Paso Natural Gas Co., has announced they will build the largest single rotary kiln mercury recovery unit in the world near Weiser, Idaho.

The firm has taken over a lease on mining claims in that area that it will operate on an open-pit mining basis for production of low-grade cinnabar ores.

Prospect in New Mexico

Tidewater Associated Oil Co. of San Francisco has obtained an exploration permit from the New Mexico-Arizona Land Co. to prospect for uranium on 250,000 acres of land west of Albuquerque, N. M.

The agreement provides that Tidewater will be granted a lease on any land upon which it finds commercial quantities of uranium, under a royalty arrangement, according to T. W. Cabeen, vice-president of the New Mexico-Arizona Land Co. Present plans call for the expenditure of $400,000 within the next two years by Tidewater.

Washington Copper Mill

Chewelah Copper Co. has started production of copper concentrates at its recently-acquired mill in Stevens County, Wash. About 2000 tons of ore from the company's mining operations northeast of Chewelah had been stockpiled for milling.

Present mine production is coming from the United Copper and Amazon claims at the rate of about 100 tons per day while diamond drilling of the Keystone vein is continuing. The first completed hole indicated the Keystone to be 40 ft wide.

Meet in Black Hills

On October 2 to 5, inclusive, the Black Hills section of AIME will be host to the mining branch of the Institute at a regional meeting. A program has been arranged that will be of interest to mining men and their ladies as well.

Technical sessions will be held on the campus of the South Dakota School of Mines and Technology in Rapid City on the 3rd and 4th. There will be papers on coal, industrial minerals, geology, mining, minerals beneficiation, mineral economics, mineral education and geophysics.

There will be special trips and activities for the ladies and October 5 has been set aside for field trips to points of interest to mining men in the vicinity.

Pre-registration information can be obtained from Professor E. H. Oshier, head of the Mining Department at the South Dakota School of Mines and Technology.

Arizona Uranium Mill

The Atomic Energy Commission and the Rare Metals Corp. of America, El Paso, Tex., have signed a contract for the construction and operation of a uranium-ore processing plant at Tuba City, Ariz. Construction of the plant is expected to be completed in about nine months.

The new mill, to be owned and operated by the Rare Metals Corp., will provide processing facilities for the uranium ores being mined near Cameron, Ariz. and adjacent areas.

Alaska Chrome

Alaska Chrome Corp. is currently operating the old Chrome Queen mine in the Red Mountain area of Alaska. Major project for the present, according to the company, is a 250-ft tunnel to tap the main ore body from below. C. A. Sherman, company president, reports that the target for 1955 is 8000 tons of chrome delivered to the government's stockpile at Grants Pass, Ore. He went on to say that 6600 tons have been blocked out during the past three years of part-time operation.

Alaska Chrome Corp. has entered into a shipping contract with Cook Inlet Barge Tug Co. to transport the ore as rapidly as it is mined in 1200-ton barge loads to Portland. It will go by rail to the stockpile.

Nevada Barite Mill

Construction of a 175-ton barite mill at Battle Mountain, Nev., by the Magnet Cove Barium Corp. of Houston, Tex., has been announced by the company. Twenty-three acres adjoining the town of Battle Mountain are now being cleared for construction of the mill.

Ore will be shipped from the Graystone Mine and from other properties now held by Magnet Cove. The company is a subsidiary of Dresser Industries of New York.

Idaho Scholarships

Scholarships totalling $6,235 have been awarded to 23 University of Idaho students and to one student at Northwest Nazarene College. The scholarships are awarded from a fund of $100,000 established by Bunker Hill & Sullivan Mining & Concentrating Co. and Hecla Mining Co. in 1951. The grants are made to sons and daughters of company employes.

Trustees of the fund are: L. J. Randall, president, Hecla Mining Co.; J. D. Bradley, president, Bunker Hill Mining Co.; and Dr. D. R. Theophilus, president, University of Idaho.

Build Ammonia Plant

Heavy construction is expected to start on the anhydrous ammonia plant this fall at the Geneva Works of U. S. Steel's Columbia-Geneva Steel Division, according to the Blaw-Knox Co., Chemical Plants Division, the firm which is designing and will build the plant.

Engineering work is in progress for the plant at Geneva Works, which is located near Provo, Utah, and the big task of procuring materials is under way. Ground has been cleared, foundation tests for footings have been completed, and the site is being prepared for the start of construction.

This will be the first United States installation in a major steel plant using raw coke oven gas as the source of hydrogen for ammonia synthesis essential to national defense. It is expected to start a new trend in coal chemicals recovery and to provide a significant contribution to the regional economy of the Intermountain and Northwest area.

The project will include:

(1) A 200-tpd anhydrous ammonia plant, using the Blaw-Knox—Linde low temperature separation process to recover hydrogen from the coke oven gas and to extract high purity nitrogen from the air; and using the Blaw-Knox—Montecatini process for ammonia synthesis.

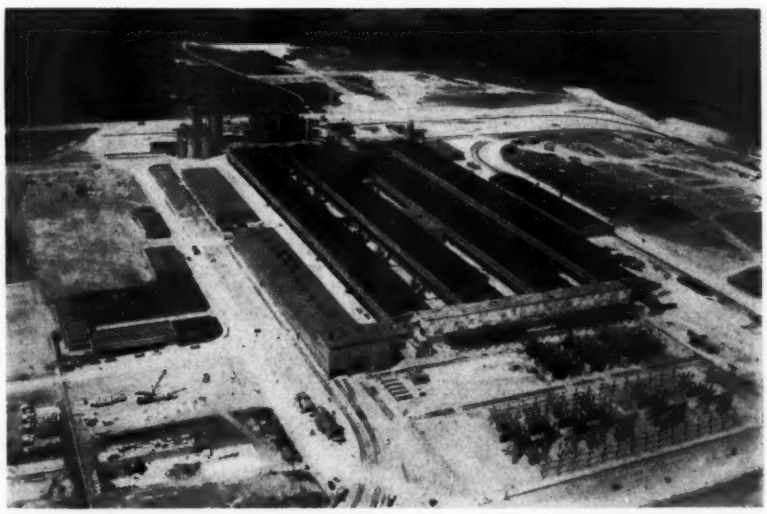
(2) A nitric acid plant based on the oxidation of ammonia.

(3) A fertilizer-grade ammonium nitrate plant, using the prilling process, producing both solid and solution forms of the product.

(4) The necessary complement of auxiliaries, including an administration building for offices and laboratory; a general service building containing a change house, machine shop, and parts storage; compressor building; utilities; warehouses; and extensive handling, bagging, storage, and shipping facilities.

The Geneva Works will be a significant new source for the expanding agricultural and processing industries of the Intermountain and Northwest areas.

Anaconda Aluminum



The $65,000,000 primary aluminum plant of Anaconda Aluminum Co. was formally opened August 15 at ceremonies held at the plantsite near Columbia Falls, Mont. First company to enter the aluminum field in this country since 1946, Anaconda commenced operations earlier in August. Russell B. Caples, company president, said he expects the new facility to reach planned capacity rate of 120,000,000 lbs. annually by January 1, 1956. About 450 persons will be regularly employed when the plant is in full production.

Raw material for Anaconda's plant is 120,000 tons of alumina per year. This is chemically refined bauxite, the principal aluminum ore, mined in Jamaica, B. W. I. Alumina is shipped here by rail from the Corpus Christi, Tex. and Hurricane Creek, Ark. plants of Reynolds Aluminum Co., under long-term purchase contract. More than 2000 box cars per year will be required to make these shipments.

The new plant is an adaptation of the design of the largest producer of aluminum in France, the Pechiney Co. Air contamination controls are said to be the best known in the whole industry. The French technology adopted for the Columbia Falls plant, it is predicted, will produce aluminum at the lowest rate of kwh consumption in this country. No industrial process water will be discharged into the Flathead River, which runs alongside the plant.

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Wyoming Geological Map

Interior Secretary Douglas McKay has announced the publication of a new geological map of Wyoming, which was prepared in cooperation with the Geological Survey of Wyoming and the Department of Geology of the University of Wyoming. The maps are available for $2.50 from the U. S. Geological Survey, Distribution Section, Denver Federal Center, Denver, Colo.

Fire at Grandview

Operations at the Grandview Mine at Metaline Falls, Wash., have been halted for an indefinite period as a result of a fire which destroyed the compressor house and blacksmith shop. The extent of the damage was not reported. John W. Currie, general superintendent for American Zinc, Lead & Smelting Co., which operates the mine under a profit-sharing agreement, said the blaze started in an oil switch that had been weakened when lightning struck near the building a few days earlier. About 25 men engaged in underground production are affected by the shutdown.

Nevada Copper Properties Sold

The mining property of the Copper Canyon Mining Co. near Battle Mountain, Nev., has been purchased by Charles H. Harrington and Gordon I. Hyde, of Salt Lake City.

The property was operated during World War II by Anaconda Copper Co. under a lease agreement but has been closed down since 1952.

The new firm, which will be known as the Battle Mountain Copper Co., plans to modernize the flotation mill and to build an acid leaching plant to recover water soluble copper and copper oxides.

Explore Jenny Lind Unit

It is reported that Bear Creek Mining Co., is negotiating an agreement to conduct exploration for uranium on a 3000-acre area in Utah.

The area to be explored is the Jenny Lind unit. This was formed when several mining companies in the district pooled their claims for exploration. The agreement is that if ore is found on claims of one participating party, all other parties to the unit will share in the discovery.

Participating in the unit are Chief Consolidated Mining Co., E. J. Longyear & Co., U. S. Smelting Refining & Mining Co., Newmont Mining Co., and the Raddatz Estate of Salt Lake City. On the basis of land contributions, Chief Consolidated has a 50 percent interest in the project. This unitization, which is quite common in the petroleum industry, is unique in the mining business.

Utah Uranium Properties Sold

Sale of uranium properties located in San Juan County, Utah, at a reported price of more than $10,000,000 has been announced.

The properties involved were controlled by A. B. Ruddock, southern California financier and president of the California Institute of Technology board of trustees, and his sons Billingsley and Merritt K. Ruddock of Denver and Moab, Utah.

The Ruddock holdings included claims on each side of the Radon property owned by the U & I Uranium Corp. of Kellogg, Idaho, which was recently merged with the Federal Uranium Corp. of Nevada.

Oil Shale Development

Union Oil Co. and Sinclair Oil Co. are engaged in or planning to start work in the shale deposits of Northwest Colorado. Union is starting work on a $5 million, 1000 ton per day retort near Grand Valley while Sinclair, for the past several summers, has operated an experimental station high in the shale mountains above the town of DeBeque.

In the Sinclair process—used elsewhere economically in places where crude petroleum is more expensive—mining and retorting take place together. By applying heat to pockets underground, oil is educted without any mining operation.

Union, however, plans a conventional system which includes the mining of the rich but narrow "mahogany ledge" which provides up to 30 bbls oil per ton, retorting the shale in a continuous cycle retort and refining the crude produced in retort.

To Build Acid Plant

Industrias Quimicas de Mexico, S. A., has announced plans for construction of a new sulphuric acid plant, in the State of Michoacan, Mexico. Company officials are engaged currently in the selection of a plant site. Construction will commense soon and is scheduled for completion in 1956. Industrias Quimicas presently operates a carbon bisulphide plant at Morelia, Mich., Mex.

The new plant, which will have an initially designed capacity of 100 tpd, will be a contact plant utilizing Mexican sulphur in its operations. Availability of sulphuric acid, an essential material for most basic industries, should stimulate the industrial development of western Mexico and provide an additional source of acid supply for other industrial areas in Mexico.

Wanted

Mining engineer by large southern West Virginia Coal Company. Graduate with minimum of five years' experience desired. Excellent opportunity for qualified man. Salary commensurate with ability and qualifications. Address all inquiries to Box 189, in care of this publication.

To Sink Potash Shaft

Kerr-McGee Oil Industries, Inc. has announced it will start sinking its first shaft to mine potash in Eddy County, N. M., in September. The company has leased about 13,000 acres and is seeking bids for sinking the 1600-ft shaft.

Tungsten Tests

The Salt Lake experiment station of the U. S. Bureau of Mines has begun tests to determine whether low-grade tungsten ores from Utah, Nevada and Colorado can be treated commercially. J. Bruce Clemmer, station superintendent and chief of the Bureau's Division of Minerals Technology, said there are large reserves of tungsten ores in Western Utah, Colorado and throughout Nevada.

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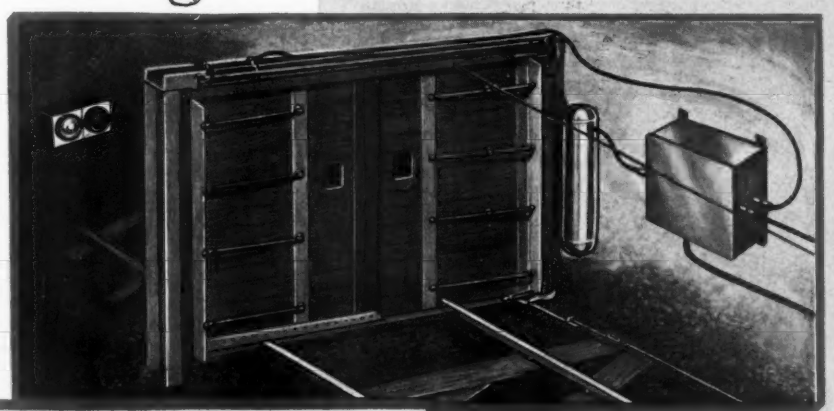

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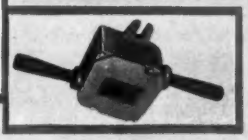

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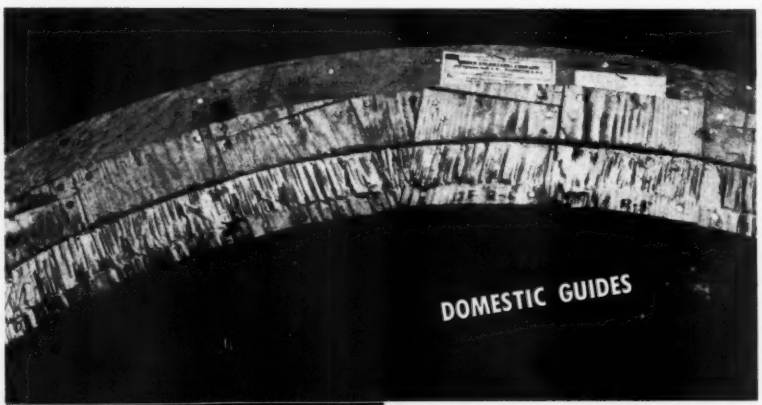

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U. S. Steel Transfer

The Coal Chemical Sales Division, U. S. Steel Corp., will be transferred to Salt Lake City. C. W. Baldwin, general manager of the division, said the transfer was due to the scehduled production of anhydrous ammonia next year at the U. S. Steel plant at Geneva, Utah, which will result in an increased production of coal chemicals.

New Mexico Uranium

Uranium production in New Mexico was six times as great in 1954 as it was in 1953, and is expected to triple this year, according to the Albuquerque National Bank. The value of uranium ore produced within the state increased from approximately $500,000 in 1953 to $3,000,000 in 1954 and is expected to rise above $9,000,000 this year. It was estimated that 1000 persons are employed directly in the state's uranium operations, while many others are engaged in exploration activities.

Alaska Dredging Operation

A new dredging operation on Bear Creek in the Basin of the Hogatza River, a tributary of the Koyukuk will be undertaken by U. S. Smelting, Refining & Mining Co., according to James D. Crawford, vice-president.

The company plans to move a 6-cu ft dredge from Livengood which will be dismantled, trucked to Fairbanks, shipped 800 miles by river boat and barge, and then hauled overland 28 miles to the mining operation.

Atlas in Australia

Atlas Corp. and associates have committed to purchase approximately $1,254,375 (562,500 Australian pounds) of the treasury stock of North Australian Uranium Corp., N. L., Floyd B. Odlum, Atlas president, has announced.

The commitment followed field checks made by Atlas' geologist on North Australian's prospecting area in the Alligator River District of North Australia and other checks made by representatives of Atlas.

The purchase price of the stock is 5 shillings per share. The stock presently in the hands of the public was originally offered at 5 shillings per share in 1954 and was selling on the Sydney Stock Market at approximately 12 shillings per share in late June.

The purchase will make Atlas the largest stockholder of North Australian Uranium Corp. with approximately 30 percent of the outstanding stock. Atlas' associates will own approximately 20 percent of the outstanding shares, with the remaining 50 percent in the hands of the public.

Power Line Completed

The completion of a 12-mile power line from the Owens River Gorge to the Wah Chang Corp. operation near Tempiute, Nev. has boosted tungsten output to 125 tpd of ore. The mining operation is now on a six-day week, according to company officials, while the mill, on a seven-day basis, treats 700 tpd of ore.

Rehabilitate Red Devil

Rapid progress has been made in the rehabilitation work at the Red Devil mercury mine near Sleetmute, Kuskokwim area, Alaska. Underground exploration work is expected to start shortly. A shaft has been sunk 165 ft from the second to the third level. It is here the underground exploration work will begin. New camp buildings and dwellings are being built and 35 men are employed at the property.

Limestone for Sugar

Utah and Idaho Sugar Co. is planning to use the limestone deposit on Cement Mountain in Northern Pend Oreille County, Wash., in the process of refining sugar beets into sugar at its plant at Moses Lake. Company officials recently announced that a contract for quarrying the rock will be let to a Spokane firm and that production will be stockpiled for shipment to the plant next year.

To Make Jars

The Overton, Nev., facilities of Nevada Silica Sands, Inc., have been sold to Hunt Foods, Inc. The Overton facilities include a 300-ton flotation mill, which is handling the material mined on the surface.

Hunt Foods also has taken over two glass plants of Glass Containers, Inc., in Antioch and Vernon, Calif., and will operate the newly-acquired plants under the names of Glass Containers Corp. and Nevada Silica Sands Corp.

New Idaho Milling Plant

Idaho Custom Mines, Inc. has started milling operations at its Livingston property in Custer County, Idaho, treating a 2200-ton stockpile of ore mined last year under a leasing program. The mill was started on July 16.

Mining operations are conducted on a block-leasing basis, with six leasers now on the job. The mill will treat at least 75 tons of ore daily.

The company has also completed arrangements for acquisition of 22 uranium claims near the Lisbon fault in the Monticello area of Utah from the Thunderbird Mining Co. under a lease.

Expand Monticello Mill

Work is nearing completion on the U. S. Atomic Energy Commission's $2,000,000 project for expanding and modernizing its uranium ore processing facilities at Monticello, Utah. The project includes erection of a complete new mill and extensive alterations to an old plant which has been used for uranium ore reduction for several years.

The building and mechanical work is being performed by The H. K. Ferguson Co. of Cleveland and San Francisco under contract with the Grand Junction (Colo.) operations office of the A. E. C. It is expected that the new mill will be in operation by October.

The plant will utilize the raw leach process. One unit of the new mill eventually will reprocess tailings from vanadium ore processing operations which were carried on here during World War II. It has been determined that the tailings contain significant quantities of uranium.

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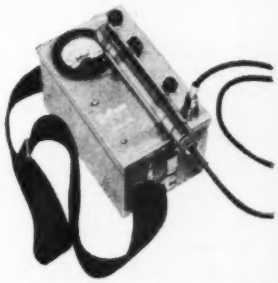

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To Lease Uranimum Lands

The U. S. Bureau of Land Management has been authorized to issue leases for mining uranium and other hard rock minerals on lands embraced by the Lake Mead National Recreation area in southern Nevada.

Approval was given by Acting Secretary of the Interior Clarence A. Davis, in Washington, D. C., after requests by the Atomic Energy Commission and numerous prospectors. Special permission was needed because the land is in a recreation area, created after the construction of Hoover Dam.

The area affected by the special mineral leasing regulations embraces a strip of land from six to 25 miles wide, lying on both sides of the Colorado River and Lake Mead.

Kaiser Buys Coal

Kaiser Steel Corp. has announced the purchase of coal lands owned by the St. Louis, Rocky Mountain & Pacific Coal Co. of Raton, N. M., for $3,500,000. The purchase involves acquisition of title to 202,950 acres of coal-bearing land, and coal mining rights on an addititonal 326,854 acres.

Kaiser does not plan to increase the scope of the coking operation at Raton, according to Jack L. Ashby, vice-president and general manager.

Officials of Rocky Mountain said the U. S. Geological Survey report estimates the reserves at 18 billion tons of coal.

AEC Declassifies Processing

The Atomic Energy Commission has declassified all technical information on currently-used extraction processes for recovering uranium from uranium-bearing materials to produce unrefined uranium concentrates. AEC announced that "the information no longer has security sensitivity." The declassification should also benefit the raw materials program by encouraging private companies to go into the uranium business and may result in development of cheaper and more efficient methods of processing uranium ores.

The relaxing of security restrictions does not free any information on the further refinements of uranium concentrates, nor does it include technical information on any new and important extraction processes.

Uranium Leases Sold

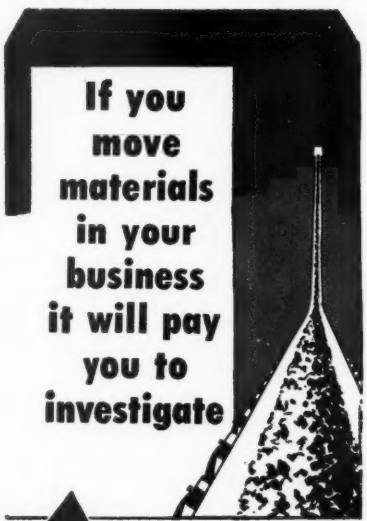
Cornucopia Gold Mines and National Lead Co. have entered into partnership in 104 mining claims in the Big Indian uranium mining district of San Juan County, Utah. This was announced August 12 by Carl M. Stolle, chairman of the board for Cornucopia.

The claims previously owned by Pemberton Industries, Inc. of Wilmington, Del., were turned over to Cornucopia the week of August 1 when Cornucopia, in a special stockholders meeting, ratified an agreement to exchange 2,000,000 shares of its stock for $100,000 and 129 mining claims.

Under the present agreement National Lead has 60 per cent interest in 104 of the claims. The balance of 40 per cent interest in these claims is Cornucopia's. Another 25 claims previously owned outright by Pemberton were also turned over to Cornucopia.

Sunshine in Stanley Basin

According to the *Wallace Miner*, Sunshine Mining Co. is acquiring half interest in Highland-Surprise Consolidated Mining Co. properties in the Fourth of July Canyon of Custer County near Stanley, Idaho, Involved in the transaction are the lead-zinc-silver claims acquired by Highland last year under lease-and-purchase option, and 20 adjoining claims located by the company. Sunshine will advance funds to cover the cost of exploration tunneling now being done by Highland.



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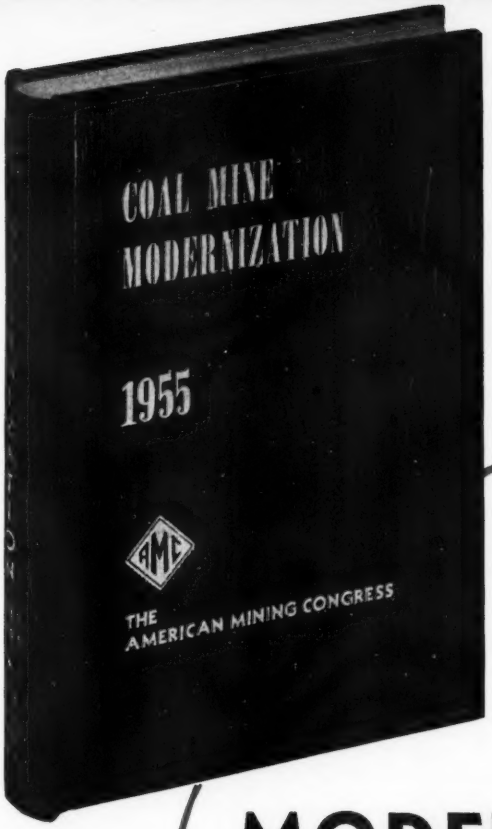

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Utex Spectrograph

Utex Exploration Co. has recently installed an emission spectrograph in its assay laboratory at Moab, Utah. The instrument will be used to assist in the analysis of ores, drill cores, and samples submitted by prospectors from all over the United States as well as from foreign countries.

The Utex machine, a two-meter instrument manufactured by Applied Research Laboratories, is capable of determining what elements are present in a given sample as well as the quantity of each element.

Crescent Ore Shoot

Bunker Hill & Sullivan Mining & Concentrating Co., Kellogg, Idaho, has encountered an ore shoot of substantial proportions on the Alhambra fault structure in its Crescent Mine on Big Creek. The west drift on the new 3110-ft level, now in about 1250 ft from the shaft crosscut, has been in ore averaging three to eight ft wide for the last 250 ft. This new disclosure is the fourth ore shoot encountered in the course of drifting, according to Stanley McDougall, manager of mines. It is a strong siderite structure liberally mineralized with chalcopyrite and tetrahedrite. Easterly drifting along the fault structure has not yet been started.

The Alhambra fault was the principal ore-bearing structure in the property when it was mined down to the 1200-ft level prior to World War II. The mine then lay idle until early 1953 when the company negotiated a contract with the Defense Minerals Exploration Administration for sinking the three-compartment Crescent shaft an additional 2000 ft and exploring extensively at this level, some 400 to 500 ft below sea level. Shaft sinking was completed last year and the deep-level lateral exploration has been in progress since.

Union Carbide to Expand Uravan Uranium Mill

This uranium processing mill of Union Carbide and Carbon Corp. at Uravan, Colo., already one of the largest on the Colorado Plateau, is undergoing a further large expansion in capacity, with new construction already in progress, according to Kenneth Rush, president of the corporation's newly-formed atomic energy division, Union Carbide Nuclear Co. The expansion plans were announced following the signing of a contract with the Atomic Energy Commission.

The additional mill capacity at Uravan is expected to be completed early in the fall of 1956. Engineering work is already well under way, and construction contracts are currently being placed. Pending completion of the new facilities, the present plant will continue to be operated at full capacity; and, as the new facilities are installed, production of uranium will be progressively increased

Wyore to Build Mill

Wyore Inc. has announced that it will build a $6,000,000 mill at Saguache, Colo., for the production of columbium ores and other rare minerals in the area. Wyore's properties in the area contain columbium, tantalum and uranium. Richard Riss, president of Wyore, said the new mill will be in operation by the middle of 1956.

Plan Phosphate Expansion

Western Phosphates Inc. has announced a $2,000,000 expansion program at its phosphate reduction center at Garfield, Utah. The company, a joint affiliate of Stauffer Chemical Co. and Garfield Chemical & Manufacturing Co., will complete the expansion late in 1956. The present rated input of rock, 92,000 tons, will be increased to 135,000 tons annually.

The expanded facilities are required to meet "the heavily increased demand for phosphate fertilizer in the Western area, despite the fact that the present plant is currently operating at 120 percent of rated capacity" said Hans Stauffer, Stauffer Chemical president.

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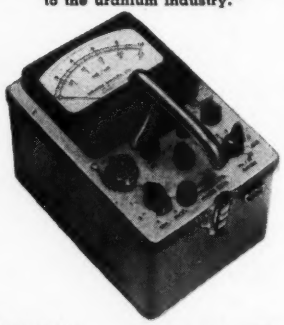

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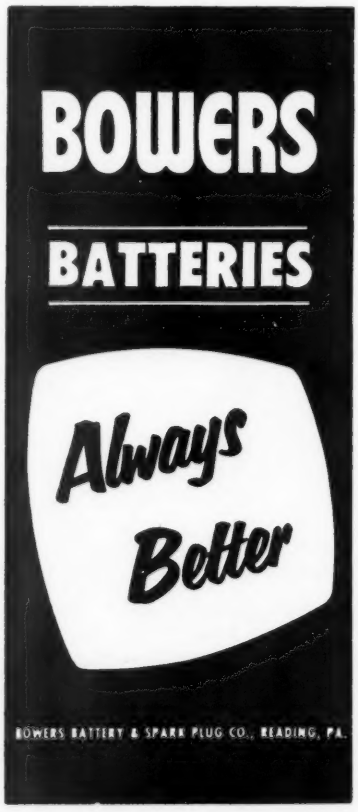
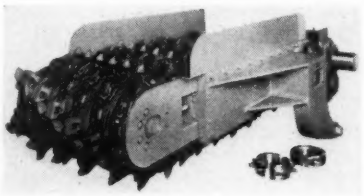
624 Rood Ave., Grand Junction, Colo.
337 N. Main St., Moab, Utah



Manufacturers Forum

New Ripper Head

Bowdil Co., Canton, Ohio, has introduced a new six-in-row ripper head for continuous mining service. Six renewable, independently adjusted cutter-bars are used which the company



says make it possible to retain equal tension on all six chains regardless of their length or age, within liberal limits. All six chains are similar in kerf and lacing arrangements for interchangeability. Included in the head assembly is a special design head drive shaft and sprocket assembly, which makes it possible to renew a sprocket without removing the shaft. Two-piece sprockets are used, held on the double keyed shaft by means of resilient clamping collars.

Geiger Counter

A portable geiger counter designed for both amateur and professional prospecting has been developed by Nuclear Measurements Corp., 2460 N. Arlington Ave., Indianapolis 18, Ind.

Known as Model GS-3, the company reports the instrument is certified to meet Navy 40-T-9 shock and vibration tests.

Literature describing the new instrument is available from the manufacturer.

Hydraulic Starter

A hydraulic starting system for diesel engines has been announced by the Allison Division of General Motors.

Called the "Hydrostarter," the starting system consists of a hydraulic motor, a piston type accumulator, an engine driven pump, a reservoir and a manual pump. No outside source of energy is needed. After the accumulator has been loaded and sealed with an inert gas, an engine-driven pump maintains pressure and the manual pump permits emergency recharging.

The "Hydrostarter" was specially engineered to operate in remote installations where cold weather and frequent periods of equipment inactivity can be detrimental to conventional electrical starting equipment.

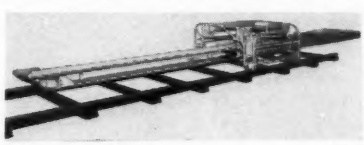
Transparent Holders for Files

Important data that require routing, multiple-handling, and quick-reference filing can be protected from grease, dirt, water and smudgy fingers yet remain completely visible, quickly identified and easily handled, when enclosed in a color-coded, transparent acetate Route-and-File Holder offered by the Baw Co., Pittsburgh.

The holder is available with five different color-coded taped edges. Each holder consists of a heat-folded sheet of acetate, closed at one edge with the colored tape. The remaining two edges are open for easy insertion or removal of the routed data at each stop. The colored tape provides fast identification in current or permanent files. They are offered in standard 8½ by 11 in. size. For additional information, write Baw Co., 9704 Frankstown Road, Pittsburgh 35, Pa.

Save Time in Loading Head Movers

The Nolan Co., Bowerston, Ohio, is now marketing a hydraulic lift dolly to transport Nolan Porta-Feeders and other car spotters from place to place in the mine. The new device has four

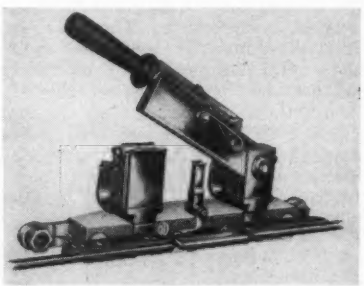


three-quarter in. roller chains equipped with hooks that are attached to loops on the bed plate of the car spotter. A hand hydraulic pump is used to raise the car spotter which can then be lowered into position through use of a release valve. The dolly with the car spotter bed plate may be moved by hand or locomotive.

Section Insulator Switch

Ohio Brass Co. announces a new section insulator switch it says will allow mine operators to maintain adequate safety blocks in feeder-trolley circuits without lowering current-carrying capacity of the circuit. Carrying 1500 amp the TS switch maintains a continuous smooth collector underrun.

Feeder cable is held in clamp-type



terminals; trolley wire in hollow screw clamping pieces. Adjustable center runner permits smooth underrun even when trolley clamps hold different size trolley wires.

When connected to 1,000,000-cm feeder and 350,000-cm trolley, the switch is rated at 1500 amps. When connected to 350,000 trolley only, it is rated at 1000 amps.

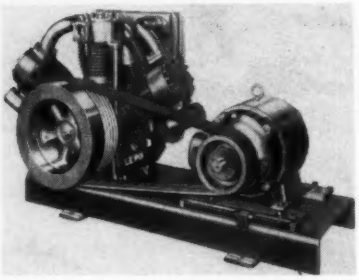
Switch accommodates 750,000-cm to 1,600,000-cm feeder and all sizes Figure 8, Grooved, and No. 9 Section trolley. Distance between mounting centers is 22⅛ in.

Scintillation Counter

The Mt. Sopris Instrument Corp., 1320 Pearl St., Boulder, Colo., announces their new Airborne-Carborne Scintillation Counter Model SC188DA. The exploration instrument is designed for light plane or helicopter installation and can be carborne. The company reports that some of the new features are: dual level discrimination against high and low energy radiation for limited spectral selection; range expanding at no sacrifice in sensitivity with a zero displacement control; and synchronous logging of absolute altitude and counting rate with a dual recorder.

New Compressor Line

A new line of two-stage, air-cooled, electric motor driven compressors has been announced by the Le Roi Division of Westinghouse Air Brake Co. These new 50, 75 and 100-hp sta-



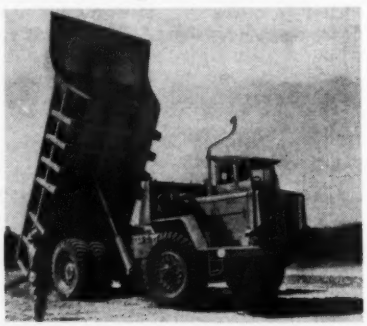
tionary compressors have displacements of 260, 415, and 550 cfm at 125-psi operating pressure.

Standard equipment of these belt-driven compressors include a Dual-Control. This control gives the operator a choice of start-and-stop duty of both motor and compressor or a continuous running of motor with intermittent compressing. The latter selection permits the compressor cylinders to unload instead of compressing when desired pressure is reached.

Additional information on the new Le Roi "S" compressor can be obtained by writing the Sales Promotion Department, Le Roi Division, Westinghouse Air Brake Co., 1706 S. 68th Street, Milwaukee, Wis.

Heavy Duty Truck

A new 40-ton, spring-mounted dump truck known as the Kenworth 803 is now being produced by Kenworth Motor Truck Corp. of Seattle. The first three units to come off the production line have been delivered to Kaiser Steel Corp., and will be used at Kaiser's Eagle Mountain Mine near



Indio in Southern California to haul iron ore.

Body capacity, struck, is 24 cu yd. Heaped load (2 to 1) is 28 cu yd. With a gross vehicle weight rating of 150,000 lb, the chassis weight of the Kenworth 803 with body is 68,000 lb. The vehicle measures 12 ft across the front hubs, and is 14 ft off the ground over the one-man cab shield. It is powered by a single diesel engine, which will vary between 300 and 500 hp depending on the grades of the loaded haul.

Merrill-Crowe Process Acquired

Dorr-Oliver Inc. recently acquired marketing rights to the Merrill-Crowe cyanide precipitation process and the Mills-Crowe cyanide regeneration process. The newly-acquired Dorr-Oliver rights to these two familiar gold and silver recovery processes are world-wide with the exception of certain African territories.

In the Merrill-Crowe cyanide precipitation process, zinc dust is used to precipitate gold and silver from cyanide solutions. Major items of equipment used in the process include a clarifying filter, deaeration tower and either vacuum precipitate filter or precipitate press.

The Mills-Crowe cyanide regeneration process, is a method of reclaiming cyanide from waste solutions by acidulation.

Also included are rights to market all equipment and apparatus of The Merrill Co. of San Francisco, Calif., used in conjunction with either of the two processes.

Two New Scrapers

Euclid Division of General Motors Corp. is now in production on two new overhung engine type scrapers. Each has a struck capacity of 18 cu yd and utilizes Allison Torqmatic Drive consisting of torque converters and semi-automatic transmission.

Both of the new scrapers are equipped with "No-Spin" differentials to provide maximum traction by directing full torque to the drive wheel with the best footing. Model S-18 is powered by a 300 hp engine and has 27:00 x 33 tires. The Twin-Power Model TS-18 Scraper has two 194 hp engines — one driving the tractor wheels and the other providing power to the rear wheels.

Back to Solid Tires

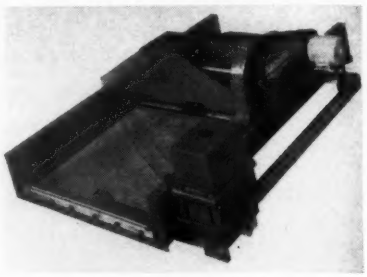
A demountable solid rubber tire for coal mine shuttle cars that the company says doubles tire life, allows higher speeds and eliminates unexpected tire failures has been announced by United States Rubber Co. The tire is called U. S. Royal Mine Cushion.

There are three sizes designed to replace six sizes of pneumatic tires now used widely on shuttle cars in low seam coal operations. Solid rubber tires are said to ride easier than pneumatics at the speeds now used. Outside diameter of the tire is less, and shuttle car height is reduced, permitting a higher load.

The tire can also be used on bolting, drilling, cutting machines and other miscellaneous equipment now mounted on pneumatic tires from sizes 500-16 through 900-15.

Fine Screening

The Deister Concentrator Co., Fort Wayne, Ind., has introduced its Model E FlexFlex equipped Leahy screen.



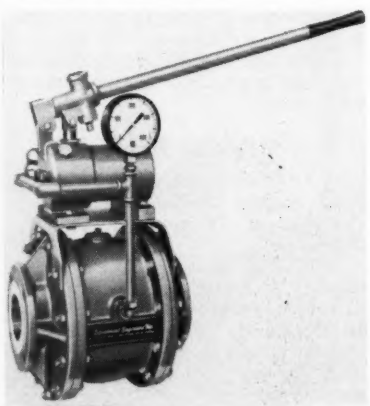
This is the most recent design of the line of screens the company manufactures for fine mesh screening, with or without jacket heating facilities. The new screen is fully described in Bulletin No. 16-EH which is available from the company upon request.

Refinish Crankpins

Aero-Motive Mfg. Co., 1803 Alcott St., Kalamazoo, Mich., has introduced a precision machine tool for refinishing diesel crankpins within the engine without removing the crankshaft. The machine runs on two-split adapters that belt on to crankcheeks. The machine itself is also built in halves, one half carrying the cutting bits and the other half carrying the honing stones. The unit is available in five sizes for crank pin diameters of 4 to 20 in.

New Rubber Slurry Valve

Equipment Engineers Inc., 41 Sutter St., San Francisco 4, Calif., have recently announced an advanced development in rubber slurry valves. Especially designed for better control of abrasive and corrosive flows, the Krebs Rubber Slurry Valves are encased in cylinder grade castings and said to be rupture-proof with maximum abrasion resistance, center orifice flow and simple remote fingertip control of hydraulic pressure. According to the manufacturers, the



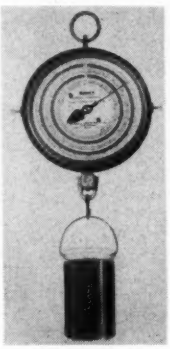
Krebs Valves elminate the disadvantages of the classical pinch valve method of controlling flow.

According to reports, these valves have been in operation for two years on thickener underflows with no maintenance expense and for one year on cyclone installations with no replacement of parts.

Write for Bulletin No. 55 to request a four-page brochure describing the Krebs Valve and giving prices.

Direct Reading Scales

A new type pulp density scales has been announced by The Mine and Smelter Supply Co., Denver. The outstanding feature of the new Marcy scales the company reports that it permits direct reading of: weight of sample in grams or kilograms; specific gravity of liquid; specific gravity of pulp; percent solids contained in a pulp of any specific gravity; specific gravity of dry solids.



The Marcy scale is applicable over any range of solids, light or heavy density. Descriptive literature and prices are available from The Mine and Smelter Supply Co., 1441 17th St., Denver, Colo.

Plastic Coated Wire Rope

An all new plastic coated cable called "Plastic-Galvanized" or "Plastic-Stainless" has been announced by Macwhyte Co. of Kenosha, Wis.

This new cable is either a preformed galvanized steel or stainless steel wire rope, coated with strong, tough, flexible plastic. The thickness of the plastic coating varies with the diameter of the rope.

According to the company, the flexibility of the rope is not adversely affected by the plastic coating.

Airborne Scintillation Counter

Engineers Syndicate, Ltd., 5011 Hollywood Blvd., Hollywood 27, Calif., features a new airborne scintillation counter with a three-in. crystal, trunion mounted. The instrument has a pust-pull circuit for fast needle response and return. Printed circuit; three-time constant positions; quick battery check are all important features of the counter. New exclusive optical coupling is said to provide better results. Background count eraser, recorder, and alarm are optional.

— *Announcements* —

John F. Myers, internationally-known author, consultant, and authority on flotation and grinding practices has joined **Denver Equipment Co.** as a consultant. Previously he was with Tennessee Copper Co. as superintendent of concentration. During his 26 years at Tennessee Copper Co. his many interesting discoveries and developments and experimental work led him closer to the work on comminution for which he is probably most widely known.

Precision Radiation Instruments, Inc., Los Angeles manufacturer of radiation instruments, has announced appointment of **Robert F. Kaufmann** as vice-president in charge of advertising and public relations.

Dr. **A. M. Ball**, manager of **Hercules Power Company's** Experiment Station Explosives Research Division, was transferred to the home office on September 1, where he will be assigned to special duties including a continuation of his present contacts with Defense Department agencies and with ordnance plants operated by Hercules.

Dr. **Lyman G. Bonner**, technical director at Allegany Ballistics Laboratory will succeed Dr. Ball at the station as manager of the Explosives Research Division, and will serve also as manager of the High Pressure Laboratory.

Robert C. Nelson has been elected vice-president of **The Long Co.**, Oak Hill, W. Va. For the past three years he has been sales manager and director of sales promotion for The Long Company. In his new position, he will continue to direct the firm's sales program and will also act as assistant to the president.

Wallace E. Gordon, assistant director of sales of the **Grasselli Chemicals Dept.** of the **Du Pont Co.**, is now director of the company's advertising department, succeeding **William A. Hart**, retired.

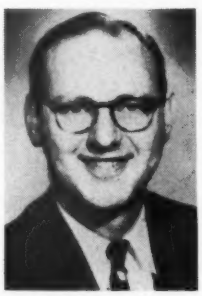
P. F. Bauer, general manager of the Norwood, Ohio Works of the **Allis-Chalmers Manufacturing Co.**, has been named general manager of the Industrial Equipment Division of the company. Bauer went to Norwood in 1952 as general manager. Before that he had been manager of the General Machinery Division's central sales region with headquarters in Cleveland.

Appointment of two to sales positions at **LeTourneau-Westinghouse Co.**, Peoria, Ill., was announced by company officials.

Jack McCann, who has been serving as manager of the company's Washington, D. C. office, has been appointed government sales manager. In his new position, he directs activities of the government sales department, including the Washington office.

Jack Errion, former advertising promotion supervisor for LeTourneau-Westinghouse, has been named Sales Promotion Manager.

T. E. Snyder has been appointed manager of advertising and sales promotion of **Exide Industrial Division** of **The Electric Storage Battery Co.** it was announced by C. J. Moore, sales manager.



Snyder, who previously was executive director of Americans for the Competitive Enterprise System, Inc., (ACES) in the Pittsburgh, Pa., area, takes over duties which were assigned temporarily to E. J. Fitzmaurice, Jr., sales engineering manager of the division.

Appointment of **Herbert J. Reid** as assistant general manager of the mechanical goods division, **United States Rubber Co.** has been announced.

Gifford V. Leece, president of **Gardner-Denver Co.** has been elected chairman of the excutive committee to succeed **Ralph G. Gardner**, who recently retired as treasurer and head of the executive committee. Gardner continues as chairman of the company's board of directors and as a member of the executive committee.

Alexander G. Lindquist, vice-president and formerly secretary and comptroller, has been named treasurer and a member of the executive committee. At the same time, **Charles M. George**, assistant to the president, was elected secretary of the company, and **William H. Miller** was named assistant treasurer.

Index to Advertisers

Allis-Chalmers Mfg. Co. 28-29
General Machinery Division
American Brake Shoe Co. ..... Insert Between 16-17
American Brattice Cloth Corp. 106
American Cyanamid Co. ..... Insert Between 16-17
American Mine Door Co. 103
Anaconda Wire & Cable Co. 63
Barber-Greene Co. 106
Bethlehem Steel Co. 15
Bixby-Zimmer Engineering Co. 98
Bowers Battery & Spark Plug Co. 108
Buckeye Coal Co. 97
Bucyrus-Erie Co. 30
Cardox Corp. 33
Cleveland Rock Drill Division 4
Westinghouse Air Brake Co.
Colorado Fuel & Iron Corp. 17
Crucible Steel Co. of America 34
Deister Concentrator Co., The 95
Denver Equipment Co. 1
Detroit Diesel Engine Division 11
General Motors Corp.
du Pont de Nemours & Co., Inc., E. I. 35
Engineers Syndicate, Ltd. 108
Ensign Electric & Mfg. Co. 97
Flexible Steel Lacing Co. 100
Flood City Brass & Electric Co. 94
General Cable Corp. ..... Third Cover
General Electric Co. 19-20-21
Greensburg Machine Co. 90
Heyl & Patterson, Inc. 14
Hoffman Laboratories Division 105
Hoffman Electronics Corp.
Ingersoll-Rand Co. 22-23
Irwin Foundry & Mine Car Co. 10
Jeffrey Mfg. Co. 2-3
Joy Mfg. Co. 27
Leschen Wire Rope Division 40
H. K. Porter Co., Inc.
Loftus Corp., Peter F. 89
Macwhyte Company 37
Mahogany Importing Co. 104
Mine Safety Appliances Co. ..... Fourth Cover
Mott Core Drilling Co. 112
National Carbon Co. 33
National Electric Coil Co. 77
Nordberg Co. 24-25
Ohio Brass Co. 36
Pattin Mfg. Co. 32
Pennsylvania Drilling Co. 112
Read, Davis 89
Reinhold Publishing Corp. 102
Reliance Electric & Engineering Co. ..... Second Cover
Sanford-Day Iron Works Co. 12-13
Sheffield Steel Corp. 39
Sprague & Henwood, Inc. 18
Standard Oil Co. (Indiana) 15
Stratoflex, Inc. 26
Terteling & Sons, Inc., J. A. 99
Thor Power Tool Co. 6-7
Timken Roller Bearing Co. 31
United States Rubber Co. 8
Universal Vibrating Screen Co. 112
Victaulic Co. of America 26
Western Machinery Co. 9
Woomer & Associates, J. W. 89

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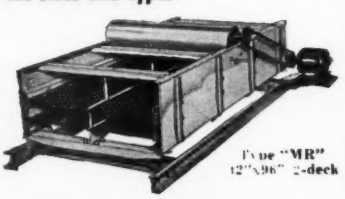

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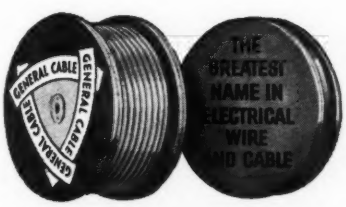

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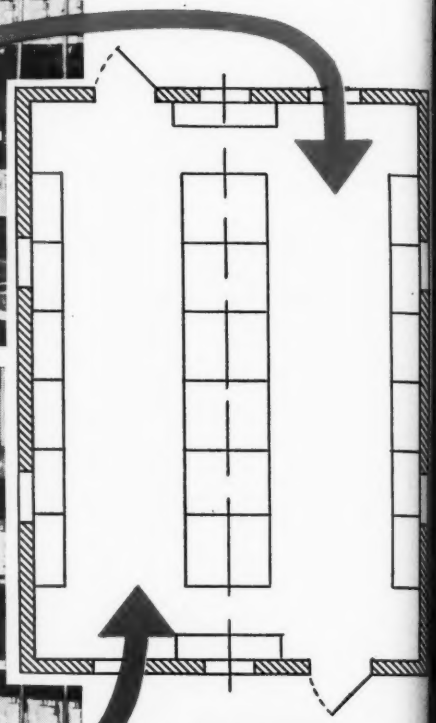

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